NUCLEAR SCIENCE ABSTRACTS

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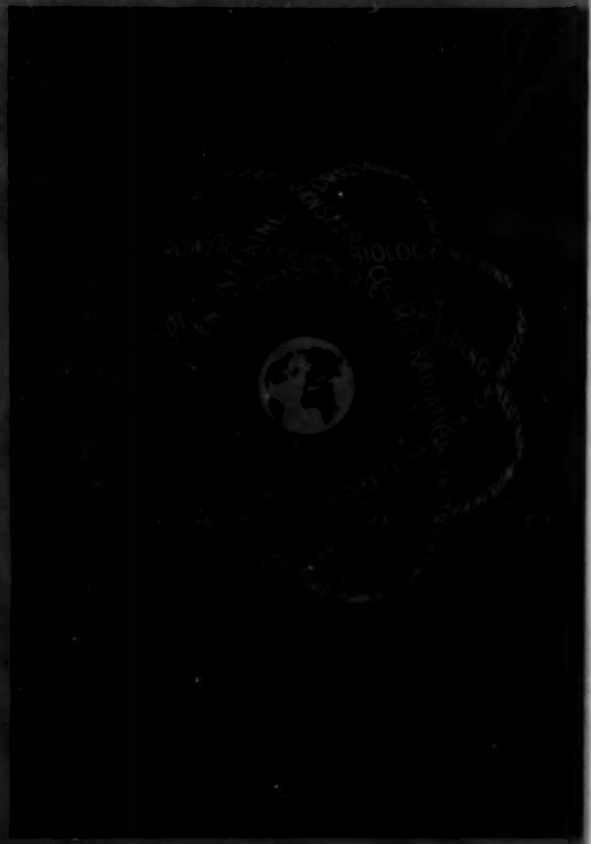

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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 21 November 15, 1959

GENERAL

18779 CF-59-5-130
Oak Ridge National Lab., Tenn.
SIZES OF U. S. STEAM-ELECTRIC PLANTS. R. C. Robertson. May 26, 1959. 15p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

At the present time, plants in the 100 to 500 Mw size range are more numerous and carry the greatest portion (over 50%) of the total steam-electric plant load in the US utilities industry. The contribution of plants of over 1,000-Mw capacity is increasing more rapidly than any other size classification and at present represents about 10% of the total capacity. By 1962 the TVA will have six plants with capacities of over 1,000-Mw. The largest steam-electric plant in the US is the TVA plant at Kingston, Tenn., with a nameplate capacity of 1,440-Mw. Turbine-generator units are also following a trend of ever-increasing size. In present construction, the 150 to 200 Mw size range for units is the most common and represents the greatest contribution to capacity. Two units of 500-Mw nameplate rating each, the largest in the US, are on order by the TVA, and an 80 Mw unit is contemplated. (auth)

18780 NP-7854
Illinois. Univ., Urbana.
DESIGN OF UNDERGROUND STRUCTURES TO RESIST NUCLEAR BLAST. VOLUME II. Final Report. (Civil Engineering Studies – Structural Research Series No. 149). J. L. Merritt and N. M. Newmark. Apr. 1958. 119p. Contract DA-49-129-eng-312.

Recommendations and procedures are presented for use in the design and construction of underground protective structures. It is assumed the structures will be subjected to nuclear blast loadings in the megaton range. Data from analytical and experimental studies used in developing the design criteria are included. The propagation of shock waves through soils and the mechanical properties of structural steels and reinforced concrete are discussed. Criteria are included for a hypothetical building. (C.H.)

18781 DSI-tr-391
THE SELECTION OF TOLERANCES ENSURING THE PRESCRIBED ACCURACY OF A MECHANISM AND THE LOWEST COST OF ITS MANUFACTURE. G. G. Baranov. Translated from Trudy Instituta Mashinovedeniya. Seminar po Tochnosti v Mashinostroyenii i Priborostrcyenii No. 11, 3-17(1957). 12p.

Fairly simple formulas for a rough determination of tolerances of a mechanism are obtained. A case is also considered where transmission ratios are variable. The lowest cost of manufacture of such a mechanism is discussed. (C.J.G.)

18782 TT-809
NEW MEASUREMENTS OF ATOMIC MASSES. (Novye Izmereniia Mass Atomov.) V. A. Kravtsov. Translated by G. Belkov (National Research Council of Canada) from Uspekhi Fiz. Nauk 65, 451-88(1958). 58p.

Consideration and evaluation are given of the values of atomic masses published from 1955 to 1958 and the contradictions existing in them. A description of mass-spectroscopic measurements of high accuracy published from 1955 to 1957 makes it possible to eliminate some errors and contradictions of previous measurements. Methods of finding errors in previous measurements and of obtaining new data of higher accuracy are given. Tables are presented giving the most accurate recent measurements of mass doublets, atomic masses of H, D, and C^{12}, and atomic masses, nuclear binding energies, and binding energies of the last nucleons of isotopes from hydrogen to zinc, from xenon to europium, and from gadolinium to lead. (C.J.G.)

18783
A LEVELING DEVICE FOR ALKALI HALIDE PRESSED DISK PREPARATION. H. W. Morgan (Oak Ridge National Lab., Tenn.). Appl. Spectroscopy 13, 1p. (1959).

The entire operation can be performed in less than thirty seconds and results in a powder of uniform density, spread evenly over the lower face of the die. (C.J.G.)

18784
EVOLUTION OF MAIN-SEQUENCE STARS. L. G. Henyey, Robert LeLevier, and R. D. Levee (Univ. of California, Berkeley and Livermore). Astrophys. J. 129, 2-19(1959) Jan.

Theoretical calculations of stellar evolution in the neighborhood of the main sequence were carried out with the UNIVAC computer at the Livermore Radiation Laboratory. The work was limited to masses ranging from 1.5 to 30 × (mass of sun) and used a primeval composition of weight, consisting of 68 per cent hydrogen, 31 per cent helium, and 1 per cent heavy elements. Interpolation formulas for opacity, equation of state, and thermonuclear reaction rates were developed. Time sequences of stellar models were computed for the various masses for the time interval during which the hydrogen content of the convective

cores decreased to essentially zero. The time variation of the relevant parameters describing the stellar interior are given in graphic and tabular form. Tracks for the various masses are exhibited in the color-magnitude diagram. A comparison of curves of constant age with cluster diagrams is made, and estimates of cluster ages are given. (auth)

18785

PUBLIC GENERATING OF ELECTRICITY OF THE SOVIET UNION IN THE SEVEN YEARS PLAN 1959/1965. B. von Gersdorff (Technischen Hochschule, Aachen). Brennstoff-Wärme-Kraft 11, 313-17(1959) July. (In German)

Between a rapid increase of demand for electricity—caused by the increasing automation and mechanization of industrial production as well as the result of the building of new branches of industry requiring much electric power—and the shortage of capital for extensions, the Russian electricity industry tries to make its contribution to the task of meeting the aims of the Seven Years Plan. Mainly lack of capital but in addition lack of labor enforce a trend away from the hitherto preferred construction of hydraulic power stations to increased extension of electricity generation from natural gas and cheap coal. Through the construction of very large power stations, the increase of density of the distribution networks and through the creation of interconnected networks the efficiency of power generation and distribution is to be improved. (auth)

18786

THE ATOMIC FORM PERIODIC TABLE. Frederick C. Strong, III (Stevens Inst. of Tech., Hoboken, N. J.). J. Chem. Educ. 36, 344-5(1959) July.

This table results in a long-form conventional table bent into a circle but with the lanthanides and actinides inserted in their rightful places. The group numbering (Roman numerals) is different, being (with a few minor exceptions) the number of electrons in the outer shell. The arrangement is such that grouping by oxidation states is made possible. (C.J.G.)

18787

WHAT CAN WITHSTAND RE-ENTRY HEAT? Missiles and Rockets, 5, No. 32, 24-5(1959) Aug. 3.

Coated molybdenum alloy, dense silicon carbide, and coated graphite are the most promising materials for the leading edge of the wings of a hypersonic global boost-glide plane such as Dyna-Soar. One limitation of molybdenum is that above 1200°F it forms a corrosive oxide that is volatile at about 1500°F. Some alloys exhibit better properties, but no truly oxidation-resistant alloy has been developed. (C.J.G.)

18788

DETECTION OF NUCLEAR EXPLOSIONS IN SPACE POSSIBLE BY OPTICAL MEANS. Savo Ćorić. Missiles and Rockets, 5, No. 32, 32-3(1959) Aug. 3.

A satellite mounted with optical instruments using spectral analysis to analyze optical phenomena particular to a nuclear blast is proposed. Advantages over satellites using radio transmitters are presented along with peace time uses of the proposed satellites. (C.J.G.)

18789

LABORATORY FOR STUDYING N-MATERIALS. A MET-VICK PROJECT. Nuclear Energy Engr. 13, 393, 406(1959) Aug.

The laboratory is equipped for examination and testing of irradiated components and materials ranging up to a complete fuel element having an activity of the order of 10 kilo-curies. Manipulation of objects is carried out by remote control handling equipment and viewed on television. A special diamond cutting machine, power-operated manipulator capable of lifting and moving objects up to 200 lb in weight, and three standard automatic polishing machines are contained in the laboratory. The laboratory, main features of which are two large concrete caves and train of five interconnected lead-walled cells, contains a decontamination area effluent treatment plant, ventilation and air filtration plant, and health physics laboratory. Examination techniques of a specimen are given. (C.J.G.)

18790

NEW INDEXING PATTERN FOR NUCLEAR SCIENCE ABSTRACTS. Melvin S. Day and Irving Lebow (U. S. Atomic Energy Commission, Washington, D. C.). Rev. document. (The Hague) 26, No. 2, 36-42(1959).

The mechanical index production system used for Nuclear Science Abstracts is described. The system makes use of a photographic machine which prepares negatives for photo-offset lithography from indexing composed on IBM cards. The index cards are photographed at 230/min. on roll film or positive paper. The cards are punched for alphabetization and sorting by IBM machines; main heading cards are coded to make best use of machine sorting capabilities and can be used repeatedly. These machines mechanize slow, expensive manual operations making possible the preparation of indexes for each issue of Nuclear Science Abstracts. The improved index listing system was introduced along with indexes improved in format and usefulness: author indexes contain short titles and report numbers; subject index gives report numbers and has improved cross references; and indexes are cumulated quarterly, semi-annually, and annually. The improved usefulness and promptness of Nuclear Science Abstracts indexes eliminates the need for unclassified AEC card catalogs. (T.R.H.)

18791

UNITED KINGDOM ATOMIC ENERGY AUTHORITY FIFTH ANNUAL REPORT FOR THE PERIOD 1st APRIL, 1958–31st MARCH, 1959. London, Her Majesty's Stationery Office, 1959. 75p. $0.70.

Research and development activities of the United Kingdom Atomic Energy Authority are reviewed for the period April, 1958 to April, 1959. Work was started on the construction of the advanced gas-cooled reactor prototype. Design of a zero energy reactor known as HERO was announced. An agreement with the United States for an exchange of information, machinery, and fuel was concluded. The last of the four Calder Hall reactors became critical in December, 1958, and the first Chapelcross reactor came into use for electricity generation in February, 1959. Scientific and engineering design work in connection with reactor research was continued. Construction work was continued on the Atomic Energy Establishment at Winfrith, and installation of the ZENITH zero energy experiment proceeded. A proposal to move the controlled thermonuclear project to Winfrith Heath was examined. A decision was reached to close the Windscale piles and seal them in view of the expense involved in rehabilitating pile No. 1 and in altering pile No. 2 to conform to safety codes. Participation in the second Geneva Conference on the Peaceful Uses of Atomic Energy is reported. An agree-

ment was signed for cooperation between the United Kingdom and Euratom. The fuel was supplied for a nuclear power plant at Latina. (C.H.)

18792
STUDIES OF THE MARKET FOR NUCLEAR MATERIALS. II. MODERATORS. B. HEAVY WATER. Paris, Organisation for European Economic Co-Operation, 1959. 28p.

The economics of heavy water are discussed in relation to world production, plant production, and future demands. Present production processes are discussed. (C.J.G.)

18793
STUDIES OF THE MARKET FOR NUCLEAR MATERIALS. III. SPECIAL METALS. Paris, Organisation for European Economic Co-Operation, 1959. 123p.

This study is confined to materials for which there is an appreciable demand for nuclear energy purposes or which have to be specially fabricated because of the exceptional characteristics required. Each metal is discussed along the lines of principal nuclear characteristics, nuclear uses, trend of supply and demand, present and future requirements for nuclear purposes, and the probable trend in prices. The metals under consideration include bismuth, boron, cadmium, lead, lithium, low cobalt steel, magnesium, molybdenum, and zirconium. (C.J.G.)

18794
COMPARATIVE STUDY OF ATOMIC LEGISLATION IN EUROPE. Paris, Organisation for European Economic Co-Operation, 1959. 112p.

A comparative study of legislation pertaining to the use, handling, security regulations, transport, health aspects, and patents of nuclear fuels and nuclear equipment is discussed in relation to various European countries. (C.J.G.)

18795
ESTIMATES OF NUCLEAR ENERGY PRODUCTION IN EUROPE, 1958–1965. NATIONAL PROGRAMMES. BASIS FOR CALCULATING CAPITAL COSTS—COST FACTORS. Paris, Organisation for European Economic Co-Operation, 1959. 45p.

A summary of estimates of nuclear energy production in Europe for the period 1958-59 is presented with respect to installed nuclear capacity, nuclear fuel requirements, costs of meeting these requirements, and capital investment necessary for the building of nuclear power stations. Data on the possibility of projecting these estimates up to 1975 are presented. The programs of O.E.E.C. countries are summarized. A discussion of basic technical assumptions adopted for the estimate of fuel requirements and costs is presented in detail. Various cost factors in the generation of electricity are analyzed. (C.J.G.)

18796
FINANCING NUCLEAR ENERGY PROGRAMMES AND RELATIONS BETWEEN THE STATE AND INDUSTRY. Paris, Organisation for European Economic Co-Operation, 1959. 54p.

This study concerns the financing of nuclear energy programs by public financing (including national budget allocations), contributions from private industry, and the relationship between industry and the state for each individual country. The countries under discussion are Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland, and the United Kingdom. (C.J.G.)

18797
STUDIES OF THE MARKET FOR NUCLEAR MATERIALS. I. FUELS. Paris, Organisation for European Economic Co-Operation, 1959. 20p.

The uranium market is characterized by an abundance of production and a tendency towards a lowering in prices. Result of this situation is a slowing down of prospecting and mining of new fields. Known ore reserves with worthwhile uranium content are sufficient, in the event of a noticeable rise in demand to envisage a corresponding increase in production by opening up new uranium fields. Such a rise would have little influence on sale price which should be about \$8/lb. of U_3O_8 content for the period 1960 to 1965. The immediate problem is to reconcile the tendencies of the short-term situation, characterized by abundant production, fall in prices, and slowing down in prospecting with the working of new fields which may be necessary to meet the requirements of the long-term market. All reserves with a worthwhile uranium content should be evaluated immediately to prepare for future exploitation. (C.J.G.)

BIOLOGY AND MEDICINE

18798 AERE-R-2988
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
RADIOACTIVE AND NATURAL STRONTIUM IN HUMAN BONE—U.K. RESULTS FOR MID- AND LATE 1958. F. J. Bryant, J. C. Cotterill, E. H. Henderson, G. S. Spicer, and T. J. Webber. June 1959. 11p. \$0.42 (BIS).

Results of analyses for strontium-90 and natural strontium in samples of human bones in mid- and late 1958 are given. A comparison of the Sunshine strontium unit values with those previously reported shows an upward trend in the case of stillbirths, infants, and adolescents. (auth)

18799 AF-SAM-59-33
California. Univ., Los Angeles. Atomic Energy Project.
LATE EFFECTS OF TOTAL-BODY ROENTGEN IRRADIATION. LONGEVITY AND INCIDENCE OF NEPHROSCLEROSIS AS INFLUENCED BY PARTIAL-BODY SHIELDING. Baldwin G. Lawson, Marta S. Billings, and Leslie R. Bennett. Sept. 29, 1958. 15p.

Two hundred forty-two female Wistar rats were observed throughout their life span following 1,000 r hypoxic total-body or partial-body irradiation. Hypoxic radiation with superimposed anesthesia resulted in 67 percent 30 day mortality, compared to 9 percent mortality without anesthesia. Selection of the colony by acute postirradiation deaths did not influence the magnitude of late radiation sequelae as measured by life-shortening. Growth retardation during the second postirradiation year was well correlated with life-shortening. Life-shortening was observed after partial-body irradiation to an extent approximately proportional to the weight of radiated tissue. Nephrosclerosis was not observed unless the upper abdomen was included within the radiation field. Other than nephrosclerosis, a similar incidence of disease was observed at death in control and irradiated rats whether partial-body or total-body irradiated. (auth)

18800 AF-SAM-59-34

Chicago. Univ. Air Force Radiation Lab.
EFFECTS OF BETA-AMINOETHYLISOTHIOUREA (AET) ON ENZYMES OF ANIMAL TISSUES. Gerald R. Zins, Ann B. Raymund, and Kenneth P. DuBois. Apr. 1959. 15p.

The effects of the radioprotective compound β-aminoethylisothiourea (AET) on sulfhydryl enzymes of mammalian tissues have been determined, in an effort to obtain information regarding the biologic activity of the drug. A number of enzyme systems involved in oxidative carbohydrate metabolism of rat tissues were inhibited in vitro by concentrations of AET within the predicted in vivo range following sublethal doses. Two of these enzyme systems, the pyruvic and alpha-ketoglutaric acid oxidizing systems of rat liver and kidney, were also markedly inhibited in vivo by AET. Inhibition was not due to an effect on coenzymes involved in the reactions but may have been caused by inactivation of the electron transport system. The time of onset of enzyme inhibition and the rate of reversal were in agreement with the onset and severity of toxic manifestations in the rat following AET administration and, furthermore, were correlated with the time of maximum radioprotection. However, a study of the susceptibility of several liver enzymes in different species failed to establish a relationship between either the toxicity or the radioprotective activity of AET and the degree of sulfhydryl enzyme inhibition. AET also stimulated anaerobic glycolysis in rat liver slices and produced lactacidemia in rats after parenteral administration. Efforts to locate the enzymatic site of the glycolytic action were not successful. The results of this study demonstrate the feasibility of a theory of radioprotective mechanisms involving the formation of radioresistant complexes between the protective agent and important biologic sulfhydryl groups. (auth)

18801 AF-SAM-59-58

School of Aviation Medicine, Randolph AFB, Tex.
RADIATION-INDUCED CENTRAL NERVOUS SYSTEM DEATH. A STUDY OF THE PATHOLOGIC FINDINGS IN MONKEYS IRRADIATED WITH MASSIVE DOSES OF COBALT-60 (GAMMA) RADIATION. Stephen G. Wilson, Jr. Dec. 18, 1958. 19p.

The pathologic alterations produced in the central nervous system of Macaca mulatta monkeys by doses of ionizing radiation exceeding 10,000 r have been described in detail in the literature. This study reveals the pathologic changes occurring in the remaining viscera of such animals. Whereas other authors have emphasized the changes found in the brain and pituitary, this report presents circumstantial evidence indicating that gastrointestinal damage is also an important part of the syndrome of radiation-induced central nervous system death. Also, the observed central nervous system changes are compared to those described by other authors. The concept of leukocyte devitalization is introduced. (auth)

18802 AF-SAM-59-68

School of Aviation Medicine, Randolph AFB, Tex.
NEUTRON ACTIVATION OF GOLD DENTAL RESTORATIONS IN SMALL PRIMATES. Robert W. Zellmer, Jack L. Hartley, Everett O. Richey, and Norman O. Harris. Feb. 2, 1959. 6p.

Dental gold alloys of various kinds were used to cast inlays which were placed in the molars of 10 small primates. These primates were then exposed to the neutron flux of an atomic detonation. The inlays were removed and the neutron-induced activity of the gold was measured in a scintillation counter. Calculation of the total activity showed a correlation with the neutron dosages received by the primates. (auth)

18803 UCLA-444

California. Univ., Los Angeles. School of Medicine.
SEMIANNUAL PROGRESS REPORT FOR THE PERIOD ENDING JUNE 30, 1959. 82p. Contract AT-04-1-GEN-12. $13.80(ph), $4.80(mf) OTS.

Brief summaries are presented of publications and reports prepared during the period. (C.H.)

18804 UCLA-445

California. Univ., Los Angeles. School of Medicine.
INEFFECTIVENESS OF 1000 ROENTGENS IN VITRO ON THE APPARENT VIABILITY OF LYMPHOCYTES IN FRESHLY DRAWN BLOOD. Benedict Cassen and Willi Gutfreund. Aug. 14, 1959. 13p. Contract AT-04-1-GEN-12. $3.30(ph), $2.40(mf) OTS.

A technique developed for separating lymphocytes from freshly drawn whole blood was found to work well on rabbit's blood obtained by cardiac puncture. The separated lymphocytes showed typical ameboid motions 8 hours later when observed under a phase microscope. Samples of blood irradiated in vitro and receiving a dose of 1000 roentgens, showed after 6 hours the same viability as the controls. In each sample 25 lymphocytes were observed, almost all showing ameboid motions. Cell counts showed that lymphocytes were not lost by rapid lysis or by being phagocytized during irradiation. These observations are offered against hypotheses which explain the rapid decrease of lymphocyte count after total-body radiation on the basis of a direct lethal effect of the radiation on mature lymphocytes. It is not ruled out that they may be sublethally affected. If the lymphocytes are long lived cells, as appears probable from the results of several investigators, it would appear that new hypotheses are required to explain their rapid disappearance from the circulation after total-body radiation. (auth)

18805 UR-531

Rochester, N. Y. Univ. Atomic Energy Project.
CONSTANT PROTEIN CATABOLISM OF WALKER CARCINOMA 256 AND HUMAN SKIN EPITHELIUM IN TISSUE CULTURE. Harry C. Jordan, Leon L. Miller, and Phyllis A. Peters. Oct. 1, 1958. 101p. Contract W-7401-eng-49. $16.80(ph), $5.70(mf) OTS.

The protein catabolic rate has been determined by labeling in vitro the proteins of growing Walker 256 cancer cells with lysine-6-C^{14} and measuring the subsequent transfer of radioactivity to the TCA soluble fraction of the culture medium over a period of four days. The cell stock used has for months retained its original appearance, growth characteristics, and 100% lethality on rat reinoculation. Such growing cultures with 95% of radioactivity in proteins, at the outset were incubated for four days with daily washings and change to unlabeled medium. At the end of each experiment 6% TCA was added to each culture. Assays for C^{14} radioactivity of cell proteins and all non-proteins were totaled as 0 time radioactivity. The per cent radioactivity transferred from the protein of the culture to the non-protein of the medium on each day was calculated, correcting for losses as protein and cell debris. From this data, the biological half-life (τ) was determined graphically. The definitive experiment involving four cultures determined τ as 5.03 ± 0.07 days (4.89-5.21 days) and

the catabolic rate as 12.9%/day. Preliminary experiments using less refined technique showed a range in τ of 4.76–5.50 days for six determinations. The protein catabolic rate is not a function of nutrient placental cord serum concentration or of the growth rate and is only a slowly varying function of nutrient amino acid concentration. There is a net transfer of soluble C^{14} labeled cell protein into the medium at a rate that is constant within each experiment, but which is not reproducible between experiments. At least one other cell type, i.e., human skin epithelium, exhibits a similar catabolic rate and net protein transfer in tissue culture. (auth)

18806 UR-544

Rochester, N. Y. Univ. Atomic Energy Project.
FIELD STUDIES OF FISSION PRODUCT INHALATION. PART 1. FISSION PRODUCT INHALATION FOLLOWING AN EXPERIMENTAL IN-PILE MELTDOWN. Robert G. Thomas, Robert H. Wilson, Geneva A. Smith, and Randi Lie. Apr. 1, 1959. 21p. Contract W-7401-eng-49. $0.75(OTS).

The quantities of fission products released to the atmosphere from the rapid meltdown of a fuel element in this experiment were of very low magnitude because of, among other factors, the limited operating time on the fuel elements. Because of the low level of elemental iodine collected on the aerosol sampling devices employed, it was not possible to calculate meaningful figures for lung deposition in rats subjected to the radioactive cloud. Whole body rat counting is a good quantitative method of adjudging the relative aerosol concentrations to which animals have been subjected, but a meaningful interpretation of these data in terms of hazards evaluation would be difficult. (auth)

18807 AEC-tr-3774

STUDY OF SIX CASES OF ACCIDENTAL ACUTE WHOLE-BODY IRRADIATION. H. Jammet, G. Mathe, B. Pendic, J. -F. Duplan, B. Maupin, R. Latarjet, D. Kalic, L. Schwarzenberg, Z. Djukic, and J. Vigne. Translated by Thomas L. Shipman (Los Alamos Scientific Lab.) from Rev. franç. etudes Clin. et biol. 4, 210-25(1959). 30p. $4.80(ph), $2.70(mf) JCL.

On October 15, 1958, at the Vinca, Yugoslovia, center of nuclear studies, six persons were irradiated by neutrons and gamma rays from a nuclear reaction. Everything indicated that the doses received approached or surpassed those normally regarded as lethal. On the following day the patients were sent to Paris and hospitalized in the radiopathology service of the Curie Foundation. The exact evaluation of the radiation doses received presented difficult problems. It proved necessary to correlate the clinical course with the physical findings in order to determine the course of therapy. This depended on the radiation doses received. Furthermore, the patients appeared to be in different dose ranges, one with a sub-lethal dose, four with doses in the lethal range, and the last with a supra-lethal dose. This distribution provided an exceptional opportunity for a theoretical study. We were guided solely by the medical requirements which frequently were far removed from the rigid considerations of biologic experimentation. The patient with the lowest dose received nothing but standard treatment, the other five received transfusions of hematopoietic cells. Four of these cases actually survived in satisfactory condition. The most highly irradiated man died of gastro-intestinal complications on the 32nd day after irradiation, although the bone marrow transplant indicated his hematologic recovery. These cases are reported here as studies showing successively the dosimetry, the clinical course, and the therapy. (auth)

18808 CEA-tr-A-589

EXAMEN DE DIFFÉRENTES SUSPENSIONS RADIOACTIVES DE PHOSPHATES EN VUE DE LEUR APPLICATION THÉRAPEUTIQUE EN RADIOTHERAPIE. (Examination of Different Radioactive Phosphate Suspensions with Respect to their Therapeutic Application in Radiotherapy.) Heinrich Kutzim. Translated into French from Strahlentherapie 104, 551-7(1957). 17p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 7111.

18809 JPRS-L-1438-D

THE AFTER EFFECT OF IONIZING RADIATION ON THE VITAMIN C AND CAROTENE CONTENT OF CERTAIN PREPARATIONS AND FOODSTUFFS. G. M. Yegiazarov. Translated from Voprosy Pitaniya 17, No. 5, 9-11(1958). $0.50(OTS).

A direct relation was noted between the irradiation dose and the percentage loss of vitamin activity in food products. Among the vitamins studied, it was found that vitamins C and B were affected most by the action of gamma radiation and that provitamin A, or carotene, was the most stable. Data are presented on changes induced in vitamins by radiation exposure. (C.H.)

18810

COMPARATIVE METABOLISM OF CALCIUM AND STRONTIUM IN THE RAT. R. C. Likins, A. S. Posner, M. L. Kunde, and D. L. Craven (U. S. Depart. of Health, Education, and Welfare, Bethesda, Md.). Arch. Biochem. Biophys. 83, 472-81(1959) Aug.

The comparative metabolism of calcium and strontium was studied in the rat. Animals were injected intraperitoneally, under varying conditions, with solutions containing Sr^{89} and Ca^{45}. The appearance of these isotopes, with the passage of time, was observed in the tibia, dentin, plasma, and urine by periodic sacrifice from experimental groups. After 10 days of daily injection, the bone and dentin of the rats contained 30% more Ca^{45} than Sr^{89}. Time sequence retention studies also showed that the Sr^{89} : Ca^{45} ratio of the plasma remained near unity during the experiments, while the urine ratio continuously fell with the passage of time. Examination of the feces 24 hr after injection revealed a reduced ratio as in the case of urine. Ultrafiltration experiments showed that bound Ca^{45} and Sr^{89} in the plasma were essentially the same 1 hr and 12 hr after injection. Thus, the continuous drop in ratio in urine could not be explained by preferential binding of Ca^{45} in the plasma. Synthetic hydroxyapatite samples tagged with Sr^{89} and Ca^{45} exhibited a preferential loss of Sr^{89} when the samples were shaken with calcium acetate solution. The apatites were prepared by hydrolysis of $CaHPO_4$ and by direct precipitation from solution. The differences between these preparations are discussed. The discrimination of the animal against Ca^{45} in the urine and feces is probably regulated on the bone level as well as by the kidney and gut function. (auth)

18811

RADIOISOTOPES IN LIVER DIAGNOSIS. W. Bolt, G. Lehnert, G. Zerlett, and F. Ritzl (Medizinschen Universitätsklinik, Cologne). Atomkernenergie 4, 271-6(1959) July-Aug. (In German)

All the known diagnostic procedures in liver conditions with the help of radioisotopes are mainly based on two phenomena: radioactive substances which are excreted through the biliary system as well as isotopes which can be stored in the reticuloendothelial system of the liver may be applied. The most important publications in this field of diagnostic use of radioactive isotopes and of its results are mentioned. The purpose of the experiments which are reported here, was to give information about the circulatory condition in various liver diseases. The method is based upon the different outflow of a radioactive substance from tissue with disturbed local circulation after intravenous application of radioactive sodium iodide ($Na^{131}I$). Thus the "local clearance" which results from local circulation and diffusion, about which the earlier methods of determining the circulatory conditions within the liver do not give any information could be determined. After blocking the thyroid with inactive iodine, the elimination of intravenously applicated $Na^{131}I$ from the human liver was observed in vivo. The radioactivity in the normal liver disappeared rapidly (in accordance to the radioactivity in the blood); cirrhotic livers, however, showed a remarkably delayed elimination of the isotopes. A small, but noticeable difference between the elimination of isotopes from the liver in young and old sclerotic patients was also observed. (auth)

18812

THERAPY WITH RADIOACTIVE CHROMIUM PHOSPHATE SUSPENSIONS. H. Kutzim (Universität, Cologne). Atomkernenergie 4, 276-80(1959) July-Aug. (In German)

The fundamentals of therapy with radioactive colloids and suspensions are discussed. The physical data of P^{32}, which are important for therapy, are compared with those of Au^{198}. The biologically different reactions of $CrP^{32}O_4$ suspensions and Au^{198} colloids are shown by a survey of experimental results on animals. A method to determine directly the solubility of a radioactive compound in living animals is described. The results of these investigations with various phosphoric acid salts are reported. The therapeutic uses of $CrPO_4$ suspensions in carcinomas of the skin, bladder, peritoneum, and pleura are illustrated with experimental results. (tr-auth)

18813

THE EFFECTS OF LOW RADIATION DOSES ON THE SIGNAL PRODUCTION AND PROPAGATION PROPERTIES IN FROG NERVES. W. Krobel and G. Krohm (Universität, Kiel). Atomkernenergie 4, 280-6(1959) July-Aug. (In German)

The effects of alpha radiation on functioning labeled nerve preparations were investigated by use of the electrical measurement method. The radiation dose was between 2 and 6 r. The radiation effect on variations of the nerve functions, such as the action potential pattern, the pulse-time voltage curve, and the signal propagation time, was determined as a function of the irradiation time and the age of the nerve preparation. The results show that at irradiation doses of 1 r visible variations in the functioning occur. These always lie in the direction of a more rapid or premature aging of the nerves. After cessation of the radiation a recovery phase persisting for some time occurs. (tr-auth)

18814

THE EFFECT OF IONIZING RADIATION ON DPN-COUPLED ENZYME SYSTEMS. O. Hug and L. Schachinger (Universität, Munich). Atomkernenergie 4, 290-6(1959) July-Aug. (In German)

The influence of x irradiation on the reactions $C_2H_5OH + DPN \xrightarrow{ADH} CH_3CHO + DPNH$ (I) or $CH_3CHO + DPNH \xrightarrow{ADH} C_2H_5OH + DPN$ (II), both catalyzed by alcoholdehydrogenase, was studied as an example of the irradiation effects on the kinetics of enzymes. A dose rate of 15,600 r/min resulted in an inhibition of reaction (I) during the irradiation, expressed by a decrease of the reaction constant. The enzyme ADH, if irradiated alone before the reaction was started, showed only slight inactivation. The radiation-sensitivity of DPN was comparatively high. Irradiation of DPN before the start of the reaction decreased the rate of the reaction to about the same extent as irradiation during the course of the reaction. No direct irradiation damage to DPN could be observed, since its concentration remained unchanged and since the reaction regained its former activity when there was an interval of 30 to 60 min between cessation of the irradiation of DPN and the start of the reaction. It is concluded that the irradiation produces some reversible change in the DPN-molecule. Irradiation of reaction (II) resulted in a remarkable increase of the reaction rate during course of irradiation. As soon as it was stopped the reaction showed a decrease in rate which was greater than that of reaction (I) at the same dosage. Since it is known that the enzyme ADH is slightly inactivated by irradiation, the increase in reaction rate seems to be due to some radiation-induced chemical reaction which is superimposed on the enzymatic reaction. It was found that the reaction $CH_3CHO + DPNH \rightarrow C_2H_5OH + DPN$ takes place under irradiation also in the absence of enzyme. (auth)

18815

PROBLEMATICS OF RADIATION PRESERVATION OF FOOD MATERIAL. J. Kuprianoff (Bunderforschungsanstalt für Lebensmittelfrischhaltung, Karlsruhe, Ger.). Atomkernenergie 4, 296-9(1959) July-Aug. (In German)

In spite of intense research work in the field of food preservation by ionizing radiation, the discussions about the value and economic status of the new processing method, as well as about the wholesomeness of the irradiated foods, are still going on. It is shown that the realization of the food preservation by irradiation is already possible on a commercial scale; the cost of irradiation can be estimated for the time being only very approximately, but it seems that the application of ionizing radiation to single products will be of economical interest. The results of feeding experiments on wholesomeness of irradiated foodstuffs have still to be proved. Also, up to now only in single cases has it been possible to eliminate or avoid off flavors and other deleterious effects in irradiated produce. Intensive research on both problems is going on. (auth)

18816

PROBLEMS OF THE RADIATION SICKNESSES IN HIROSHIMA AND NAGASAKI AND AFTER THE H-BOMB TEST IN BIKINI. H. Keim. Atomkernenergie 4, 313-22(1959) July-Aug. (In German)

Geographical conditions, accommodations, disregard of the warning system, and the lack of sufficient first aid may partly account for the great total losses of lives at Hiroshima and Nagasaki. Due to the fact that the detonation happened at a height at 500 m the contamination of the surface did not reach a higher extent in the destroyed area. This is easily proved by the results of

the first measurements. Out of the 100,000 deaths, irradiation by the initial gamma rays accounts for about 20%. For the remaining 80% death is due to mechanical injuries and burns. The surviving injured had however, very often the acute radiation syndrome. Among the surviving population within the radius of 1500 m from the hypocenter late effects were proved by statistics. Some 16 cases of microcephalia in connection with low intelligence with children at a gestation age between 1 to 4 months during the time of the bombing. The significant raising of the leukemia rate up to ten times more than normal. Because of the wide spread of parasitic and toxic blood diseases certain difficulties are arising with the classification of an anemia due to a radiation late effect. Functional disturbances at the generation organs were finished 2 years later. No doubt genetic damages must be expected. However, it would be impossible to find a final judgment relating kind and frequency, especially as far as the first generation is concerned. (auth)

18817

THE EFFECT OF IONIZING RADIATION ON NUCLEAR PHOSPHORYLATION IN THE RADIO-SENSITIVE TISSUES OF THE RAT. W. A. Creasey and L. A. Stocken (Oxford Univ.). Biochem. J. 72, 519-23(1959) July.

When nuclei prepared from spleen, thymus gland, lymph node, bone marrow, and intestinal mucosa of the rat are shaken aerobically at 0° in a suitable medium, acid-labile phosphate is formed. This is not so for the radio-insensitive tissues such as brain, liver, kidney, and pancreas. Low doses of whole-body x irradiation abolish the nuclear phosphorylation. Low doses of γ irradiation given to suspensions of nuclei also prevent nuclear phosphorylation. In spleen and thymus there is a recovery of the ability to effect nuclear phosphorylation at about 100 hr after 100 r of total-body radiation. The possible significance of the observations in relation to the radio-biological lesion is discussed. (auth)

18818

AN IMPROVED METHOD AND FILMHOLDER FOR PERSONNEL MONITORING. G. Spiegler and R. Davis (Royal Cancer Hospital, London). Brit. J. Radiol. 32, 464-7(1959) July.

After discussing the limitations of the absorption method for quality discrimination, an improved method and a new filmholder are described in which use is made of secondary electron emission from a lead foil and of back-scattered radiation to characterize quality. On each film not more than two measurements are required. (auth)

18819

QUANTITATIVE STUDIES ON RECOVERY FROM WHOLE BODY IRRADIATION IN MICE. III. A COMPARISON OF DAILY EXPOSURE TO FAST NEUTRON AND GAMMA RADIATIONS. R. H. Mole, F. E. Neal, and G. J. Neary (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Brit. J. Radiol. 32, 483-7 (1959) July.

Results are reported from a series of studies on the relative recovery rates of mice from fast neutrons and gamma irradiation and the effects on recovery of differences in dose intensity. Data are tabulated. (C.H.)

18820

LEAF TUMORS INDUCED IN GRAPTOPETALUM PARAGUAYENSE BY GAMMA RADIATION. Otto L. Stein, Arnold H. Sparrow, and Lloyd A. Schairer (Brookhaven National Lab., Upton, N. Y.). Cancer Research 19, 746-8(1959) Aug.

When whole plants or leaves of Graptopetalum paraguayense are exposed to high dosages of gamma radiation, small protuberances appear on the surface of leaves after some 5 to 6 weeks. Upon histological examination it appears that new, tumor-like growth centers are the cause of these protuberances, which are distributed more or less at random throughout the tissues and apparently are self-limiting in size. At maturity these tumors consist of a dead central region surrounded by several rows of small cells. This complex is usually surrounded by a region of cell enlargement which extends into the originally normal mesophyll tissue. The number of tumors per leaf reached an average maximum of about ten in two different experiments. Since they can be counted with ease in intact leaves and metastases do not occur, quantitative data can be obtained readily. It is suggested that the system described might be useful as an assay for tumor initiation by chemical as well as by physical agents. (auth)

18821

THE PROTECTION GIVEN BY SOME GASES AND THE SENSITIZATION GIVEN BY OXYGEN OF THE RADIOSENSITIVITY OF EMBRYONIC BUDS. Jean-Michel Kirrmann (Collège de France, Paris and C. N. R. S., Paris). Compt. rend. 249, 458-9(1959) July 20. (In French)

A study was made of the effects of nitrogen, carbon dioxide, and oxygen on the radiosensitivity of buds in the chicken embryo. The radiation was chosen so as to give approximately 100% cyclocephali in the controls. The embryos were held in a nitrogen atmosphere for 4 hr before irradiation, and in a carbon dioxide atmosphere for 1 hr. For the study of the oxygen effect, a pure oxygen atmosphere was used. The number of cyclocephali resulting from the irradiation is tabulated. The results show the proportion is 92% in the controls, 30% in carbon dioxide atmosphere, and 21% in nitrogen atmosphere. For the oxygen irradiations the radiation dose was chosen to give approximately 50% cyclocephali in the controls. The proportion in oxygen was 80% and in air it was 50%. These results indicate that the inhibitory effects of nitrogen and carbon dioxide are caused by an anoxia mechanism, which suggests that the increased radiosensitivity in the oxygen atmosphere was caused by an increase of the oxygen concentration in the cells. (J.S.R.)

18822

THE FORMATION OF GLYCUROTRIIODOTHYRONINE AFTER ADMINISTRATION OF RADIOACTIVE IODINE TO THE RAT. Raymond Michel and Marcelle Gruson (Collège de France, Paris). Compt. rend. soc. biol. 153, 566-9(1959). (In French)

After administration of NaI^{131} in tracer doses not harmful to the rat, small quantities of a glycuroconjugate of thyroxine were detected in the bile. The effect is essentially physiological since it interferes with normal thyroidal secretion. These findings also emphasize the importance of this hormone which, in spite of its low blood concentration, is concealed at the level of the liver in a probably consolidated form which plays, because of its hydrolysis by β-glycuronidases of intestinal bacteria, a role in the regulation of hormones. (T.R.H.)

18823

INHIBITION OF LOCAL ANAPHYLACTIC REACTIONS

BY X RAYS. J. Hugues and J. Lecomte (Université, Liège). Compt. rend. soc. biol. 153, 709-11(1959). (In French)

Experiments are described in which local vascular anaphylactic reactions were studied in vivo. Rabbits sensitized to hen-egg white were irradiated to 700 r at 200 kv and 140 r-minute. The local anaphylactic reactions were invoked 24 or 48 hours later. The reactions were totally inhibited, there being a dimunition of parietal agglutination and a suppression of hemorrhagic lesions. (T.R.H.)

18824

THE EFFECT OF X-RAY TREATMENT OF THE MERISTEMATIC CELLS OF EMBRYO STEM IN WHEAT. I. M. Vasil'ev and E. I. Maslova (Inst. of Biological Physics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 1351-3(1959) June 21. (In Russian)

It was found that the previously described temporary elongation of wheat plant leaves, induced by growth-depressing doses of radiation, cannot be considered a true growth of cells but a result of cell expansion which stops immediately after irradiation. The appearance of early developing leaves in plants irradiated by lighter doses, which only partially depress the growth, is related to a more rapid development of irradiated leaf rudiment. (R.V.J.)

18825

THE BIOCHEMICAL MECHANISMS OF THE PROTECTIVE EFFECT OF ALCOHOL IN MICE TREATED WITH X-RAYS. S. R. Zubkova and A. L. Platonov (Inst. of Biological Physics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 1354-7(1959) June 21. (In Russian)

Experiments were carried out to determine the conditions which induce the protective effects of alcohol against irradiation, to establish the effects of preliminary administration of alcohol on the catalase activity and alcoholdehydrogenase in liver at various stages following irradiation, and to find the effects of preliminary administration of alcohol on the structural changes induced by irradiation on the bone marrow nucleoprotein. (R.V.J.)

18826

RADIOACTIVITY IN THE BLOOD DURING DEVELOPMENT OF BROWN-PEARCE CARCINOMA. K. P. Balitskii and A. I. Danilenko (Bogolomets Inst. of Physiology, Ukrainian S.S.R.). Dopovidi Akad Nauk Ukr. R.S.R. No. 4, 451-3(1959). (In Ukrainian)

Experiments were conducted on male rabbits with a Brown-Pearce carcinoma inoculated on the testicle. On the seventh day of development of rabbit carcinoma, an acute rise in beta radiation activity is noted in the blood, followed by a continuous and sharp fall up to the death of the animal. In rabbits with an undeveloped carcinoma the changes in the activity of radiation do not differ from the physiological fluctuations in the normal state. The investigation was carried out during different seasons, thus excluding seasonal effects. Since beta radiation activity in the organism is due chiefly to the activity of potassium, the data obtained are ascribed to the change in the blood potassium content. The observed drop in blood radioactivity after the seventh day of carcinoma development may be linked with the deposition of potassium in the developing tumor, particularly since the radioactivity of the organs with carcinoma metastases were raised, as shown by supplementary studies. The experimental results agree with the observations showing that in 44 investigated patients with cancer of various location the radiation activity due to potassium was somewhat elevated. (auth)

18827

DESTRUCTION OF CLOSTRIDIUM BOTULINUM BY IONIZING RADIATION. PART II. PEAS, CHICKEN SOUP, AND PORK IN THE FROZEN STATE. G. B. Pratt, E. Wheaton, C. W. Bohrer, and C. B. Denny. Food Research 24, 51-6(1959) Jan.-Feb.

Toxic swells developed in peas inoculated with 10,000 spores per gram of Cl. botulinum which had received 2.5 Mrep, but no swell spoilage developed after 3.0 Mrep. Toxic swells developed in similarly inoculated chicken soup which had received 3.5 Mrep, and a non-toxic, putrid swell developed even at 3.6 Mrep, but no swell spoilage developed after 3.8 Mrep. Toxic swells developed in inoculated pork after 3.5 Mrep, and non-toxic swells (one putrid) developed at 3.7 Mrep; no swell spoilage developed after 4.0 Mrep. Viable spores were isolated from occasional flat cans of peas and chicken soup incubated one year at 86°F, but in no case was toxin encountered in any flat cans. (auth)

18828

GAMMA RAY PASTEURIZATION OF WHOLE EVISCERATED CHICKENS. J. N. McGill, A. I. Nelson, M. P. Steinberg, and L. L. Kempe. Food Technol. 13, 75-80(1959) Jan.

Dressed chickens show microbiological spoilage after a short holding time even at refrigerated temperatures. Although meat can be sterilized by ionizing radiations, the process has several disadvantages. Deleterious chemical reactions are produced during irradiation and increase upon storage. Pasteurization doses of ionizing radiations with subsequent refrigeration storage tend to minimize these disadvantages and at the same time increase the refrigerated storage life of chickens. This study was initiated to investigate the effect of pasteurization doses of gamma rays on microbiological and organoleptic quality of plastic-film packaged, whole, eviscerated chickens subsequently stored at refrigerated temperatures. Two gamma ray sources, Co-60 and partially spent fuel elements, were used in this study. The effectiveness of the two sources was investigated in separate experiments using two dosage levels. In the third portion of this study, the two sources were statistically compared at one irradiation level. After irradiation the chickens were stored at various refrigerated storage temperatures for several time intervals prior to examination. Results of the microbiological and organoleptic analyses are reported. An extension of the storage life at temperatures 34° and 40°F were found. Irradiation flavors at the dosage levels used in this study were not found to be a problem. However, at the high irradiation level, rancidity developed in storage before the chickens were spoiled due to microbiological activity. Rancidity was found to develop at a more rapid rate at the lower storage temperatures. For the factors investigated in this work, use of Co-60 resulted in a significantly smaller population of microorganisms after storage than did use of fuel elements. (auth)

18829

THE ABSORPTION OF X RADIATION IN BONES. E. Krokowski (Freien Univ., Berlin-Charlottenburg). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 91, 76-84(1959) July. (In German)

The most important experimental and theoretical data

for the absorption and attenuation of x rays in bone tissue is tabulated, and the significance of these results for diagnosis, therapy, and radiation burden of the bone is discussed. A method of the comparative measurement of attenuation is described and should be valuable for the determination of bone mineral, particularly of the vertebrae. (auth)

18830

APPLICATIONS OF AUTORADIOGRAPHY IN BIOLOGICAL RESEARCH. N. L. Dockum, G. S. Vogt, and E. J. Coleman (General Electric Co., Richland, Wash.). J. Biol. Phot. Assoc. 27, No. 1, 18p.(1959) Feb.

Procedures are discussed for the positive identification of alpha and beta emitting particulates and their measurements by means of autoradiography. Methods are described for the localization of radioisotopes within tissue and the detection of alpha particles from plutonium-239 in accidentally contaminated personnel. Methods are discussed for illustrating autoradiographic reports. (C.H.)

18831

SOME PROMPT AND DELAYED EFFECTS OF X RAYS ON GROWTH OF HUMAN AMNION CELLS (STRAIN FL) IN TISSUE CULTURE. Henry I. Kohn and Jørgen E. Fogh (Univ. of California, San Francisco and Univ. of California, Berkeley). J. Natl. Cancer Inst. 23, 293-304(1959) Aug.

Some prompt and delayed effects of single doses of 100-kv x rays on the growth of the established FL strain of human amnion cells in tissue culture were studied. The parameters of growth measured were cell volume, number of cells per culture, and total volume of cells per culture (culture volume). The effects were dependent on x-ray dose. Small changes in the growth rate were observed after 100 r, but sterilization of the culture required 1500 to 2000 r. Growth in cell number was more sensitive to radiation than growth in cell volume; thus irradiation tended to produce a condition of continued cellular growth accompanied by mitotic inhibition. As a result, the distribution of cell volumes was widened and the entire distribution was shifted toward higher values. Giant cells represented the largest size in the changed distribution. Subcultures from irradiated cultures that had received 100 to 600 r grew out readily. After 1000 r, an exponential growth curve similar to that for unirradiated cultures was obtained after several transfers. The x-ray sensitivity of such 1000 r-recovered cultures was not strikingly different from that of the unirradiated cultures. The unirradiated cultures, however, had a less pronounced latent period. The recovery of such irradiated cultures involved, inter alia, the elimination of damaged cells by a process that may be considered analogous to natural selection. The bearing of this phenomenon on the prompt and late effects of x rays in vivo is discussed briefly. (auth)

18832

UPTAKE OF STRONTIUM BY PASTURE PLANTS AND ITS POSSIBLE SIGNIFICANCE IN RELATION TO THE FALL-OUT OF STRONTIUM-90. R. Scott Russell (Agricultural Research Council, Radiobiological Lab., Wantage, Berks, Eng.) and R. J. Garner (Agricultural Research Council Field Station, Compton, Newbury, Berks, Eng.). Nature 183, 1806-7(1959) June 27.

The extrapolation of data from pot studies to pasture conditions is questioned in studies on the absorption from soil of fall-out strontium-90 by pasture plants. It is pointed out that when cattle are fed a normal diet the ratio of strontium-90 to calcium in their milk depends primarily on the ratio of strontium-90 to calcium in their total diet, being approximately one-seventh of that quantity. Evidence is presented for the view that the present levels of strontium-90 in milk from world-wide fall-out are due primarily to it lodging directly on the aerial tissues of plants and not from strontium-90 entering the soil. In considering the contamination of plants by absorption of fall-out fission products from the soil, it is important to consider the depth from which the plant roots absorb their nutrients. It has been established that the major part of the strontium-90 which enters undisturbed soil from fall-out is retained in the upper 5 cm of soil. When pasture plants absorb strontium-90 from uniformly contaminated soil the balance between grass and clover in pastures also appears unlikely to be an important factor in determining the strontium content of milk. (C.H.)

18833

AN ALTERATION IN THE EXCRETION OF FREE SERINE IN URINE FROM IRRADIATED HUMANS. Arthur L. Kretchmar (Oak Ridge Inst. of Nuclear Studies, Tenn.). Nature 183, 1809-10(1959) June 27.

A decrease in the urinary excretion of free serine was noted in a group of eight workmen exposed to high-level whole-body gamma and neutron irradiation. In some cases a total absence of urinary free serine was demonstrated one day post-exposure. Serine was decreased but not absent from urine excreted by a child with leukemia exposed to 800 r whole-body cobalt-60 gamma radiation. (C.H.)

18834

LIFE-SPAN OF RAT AND MOUSE ERYTHROCYTES IN THE RAT-MOUSE CHIMERA. Joan W. Goodman and L. H. Smith (Oak Ridge National Lab., Tenn.). Nature 183, 1833(1959) June 27.

Results are reported from studies of the secondary disease observed in irradiated animals treated with foreign bone marrow. Evidence is presented from tracer studies which indicate that the long-term heterologous rat-mouse chimera, although 100 per cent of its circulating erythrocytes are of rat origin, provides an imperfect environment for rat red blood cells. The presence of active rat hematopoietic tissue in such a host did not influence the survival of transfused mouse erythrocytes. No evidence was found of an active rat immune system. (C.H.)

18835

POLAROGRAPHIC STUDY OF THE EFFECT OF IONIZING RADIATION ON SOLUTIONS OF PROTEINS. L. M. Buruiana (Laboratoire de Biochimie animale, Fac. Méd. Vetérinaire, Bucharest) and V. Pavlu (Laboratoire de Physique générale, Institut Polytechnique, Bucharest). Naturwissenschaften 46, 426-7(1959). (In French)

Radiation effects on horse albumin, cow globulin, and cow hemoglobulin solutions were studied by polarography. The dose rate was 0.03 r/hr. For a 5-min exposure of albumin the first wave increased and the second decreased catalytically; for the globulin mostly the second wave increased; in hemoglobin there was a negativation. At 30-min. exposure: albumin—both waves increased; globulin—return to initial height of the two waves; hemoglobin—an accentuated negativation. The curves returned to their initial appearance at 24 hours after irradiation. Repeated irradiations caused the same effects. (T.R.H.)

18836

THE PATHOGENESIS OF LIVER DAMAGE FROM X IRRADIATION. M. Skalka and L. Soškovà (Tschechoslovakischen Akademie der Wissenschaften, Brno and Medizinischen Fakultät, Brno). Naturwissenschaften 46, 430(1959). (In German)

Irradiation damage to the liver of rats was studied. The livers of 23 laparotomized rats were irradiated, with the anterior lobe of the liver shielded, to 630 r. Lipid content measurements in the second week established that irradiation of liver tissue has no effect on the origin of liver fat degeneration. To study the roles of bacteremia and sepsis, mice irradiated to 540 or 580 r were killed on the eleventh day post-irradiation, and the fat content of their heart blood and liver tissues was determined. There was no difference in mice with bacteremia and mice with sterile blood cultures. Treatment with streptomycin produced no difference. (T.R.H.)

18837

HEMATOLOGICAL STUDIES OF INCORPORATION OF LARGE DOSES OF RADIOISOTOPES IN GUINEA PIGS. Ernst Spode and Gottfried Schneider (Deutschen Akademie der Wissenschaften, Berlin and Medizinische Universitätsklinik der Charité, Berlin). Naturwissenschaften 46, 430-1(1959). (In German)

Experiments are described in which the hematological effects of radioisotopes are compared when injected in equal activities into guinea pigs. The isotopes, injected intraperitoneally in doses of 2.5 μc/gram of body weight, were: $Ba^{140}-La^{140}$, $Sr^{90}-Y^{90}$, $Ce^{144}-Pr^{144}$, $Cs^{137}-Ba^{137}$ (all as carrier-free chlorides in 1.0 ml physiological NaCl solution), P^{32} once as NaH_2PO_4 and the others as $CrPO_4$ in 1.0 ml physiological NaCl. These doses result in about 1 mc of activity/animal. Immediately before the injections and for 18 days afterward a complete blood picture was run. The effects of each isotope on erythrocyte count, leukocyte count, differential blood picture, and hemoglobin value are discussed. (T.R.H.)

18838

RECOVERY FROM PARTIAL-BODY X-IRRADIATION AS MEASURED BY THE LETHALITY OF TWO EXPOSURES. Arland L. Carsten and Thomas R. Noonan (Univ. of Rochester, N. Y.). Radiation Research 11, 165-76(1959) Aug.

For the purpose of studying recovery from partial-body irradiation, the efficiencies of various shielding procedures have been evaluated. A double wraparound shield, which was the most efficient, reduced the rate to about 1% of the outside dose at a distance of approximately 6 cm from the edge of the shield. These studies, together with appropriate dissections, have permitted estimates of dosages to various organs under the conditions of exposure employed. In confirmation of previous work, the LD_{50}'s for upper-body, lower-body, and whole-body irradiation were found to be 1750 r, 1080 r, and 750 r, respectively. By using two partial-body exposures to x radiation, separated by various time intervals, the pattern of recovery (as measured by lethal effects) has been determined for lower- and upper-body irradiation. The recovery from a lower-body exposure of 648 r can be expressed by a single exponential function with a half-recovery time of 1.7 days. The recovery from an upper-body exposure of 1300 r can be expressed by a single exponential with a half-recovery time of 7.0 days or by two exponentials, one with a half-recovery time of 3.8 days and the second with a half-recovery time of 7.5 days. (auth)

18839

AMPLIFICATION EFFECT OBSERVED IN INTERRELATED ENZYME SYSTEMS AFTER IRRADIATION. Shigefumi Okada and George Fletcher (Univ. of Rochester, N. Y.). Radiation Research 11, 177-83(1959) Aug.

The effect of ionizing radiation on the over-all reaction rate of single- or multiple-enzyme systems was studied. In each experiment, one or two components were inactivated partially by γ irradiation before being added to the system. When two irradiated components were added to the system, it was observed that the magnitude of the change in the over-all reaction rate was a multiple or the sum of the rate changes produced by irradiation of each component alone. The possible role of this type of amplification on interrelated reactions subsequent to primary radiation events is discussed in relation to the development of observable injury in irradiated cells. (auth)

18840

ENERGY ABSORPTION BY THE BONE MARROW OF THE MOUSE RECEIVING WHOLE-BODY IRRADIATION WITH 250-Kv X-RAYS OR COBALT-60 GAMMA RAYS. E. R. Epp, H. Q. Woodard, and H. Weiss (Sloan-Kettering Inst., New York). Radiation Research 11, 184-97(1959) Aug.

The deposition of energy in bone marrow by photoelectrons emitted from bone salt irradiated with x rays is a complicating factor in the interpretation of RBE values. It is emphasized that the calculations neglect the effect of backscattered radiation. This effect is negligible for the case of the mouse suspended in air. A physical model has been constructed to represent the spatial relationships between mouse marrow and the bones enclosing it. By the use of this model detailed calculations have been made of the energy absorption in marrow cavities of various sizes and shapes during whole-body exposure to 250-kv x rays or cobalt-60 γ rays. The calculations involve a double integration over all photon and electron energies concerned. The average energy absorption by the total marrow of the mouse subjected to whole-body irradiation has been calculated to be 98.6 ergs/cm^3/r from 250-kv x rays and 94.0 ergs/cm^3/r from cobalt-60 γ rays. The significance of this difference in absorbed energy in interpreting the RBE of the two radiations is discussed. (auth)

18841

PHYSIOLOGICAL AND BIOCHEMICAL STUDIES ON VARIOUS SPECIES EXPOSED TO MASSIVE X-IRRADIATION. Douglas E. Smith and John F. Thomson (Argonne National Lab., Lemont, Ill.). Radiation Research 11, 198-205(1959) Aug.

Diverse species of animals, including rats, mice, hamsters, bats, chickens, frogs, and lizards, were exposed continuously to x rays until death. All the species irradiated at 23°C died after accumulating a dose of approximately 100,000 r. A similar lethal dose was found in the case of poikilotherms irradiated in environments of 5°C and 37°C. Decreases in rectal temperature up to 10°C occurred during the irradiation of homotherms at 23°C. After accumulating doses of about 15,000 r, bats irradiated at 5°C showed spontaneous motor activity, increase in rectal temperature, and increase in oxygen consumption. No significant alterations were observed in enzyme activities of irradiated tissues which could explain the mechanism of lethal action. The capacity of rat brain for anaerobic and aerobic glycolysis was im-

paired, but that of the bat was unaltered. A decreased efficiency of phosphate esterification was observed in mitochondria from brains of rats and bats irradiated at room temperature, but not of bats irradiated at 5°C. The implications of these findings and their relationship to the existing literature were discussed. (auth)

18842

EFFECT OF IRRADIATION AND THEORY OF ROLE OF MITOTIC DELAY ON THE TIME COURSE OF LABELING OF HeLa S3 CELLS WITH TRITIATED THYMIDINE. Robert B. Painter and James S. Robertson (Brookhaven National Lab., Upton, N. Y.). Radiation Research 11, 206-17(1959) Aug.

The percentage of HeLa S3 cells in DNA synthesis at various times after 500 r of x irradiation has been determined by means of autoradiography with H^3-thymidine. The percentage rises during the period of mitotic delay so that at 4 to 8 hours after irradiation almost twice the proportion of cells are synthesizing DNA as are doing so in controls. In an attempt to explain these results on the basis of the build-up of cells in DNA synthesis occurring as a result of mitotic delay, the kinetics of the effects of irradiation on the numbers of cells in the various stages of the mitotic cycle have been determined. These kinetics are discussed with respect to their importance in the interpretation of data on the effects of irradiation of DNA synthesis, but they fail to account completely for the results reported here. Alternatively the interpretation is that many cells in DNA synthesis at time of x irradiation remain in this stage for an abnormally long time and there is no effect on the rate at which cells come into DNA synthesis. (auth)

18843

THE EFFECT OF CHELATION AND X-RAYS ON FECUNDITY AND INDUCED DOMINANT LETHALS IN HABROBRACON. Leo E. LaChance (North Carolina State Coll., Raleigh). Radiation Research 11, 218-28 (1959) Aug.

The effects of ingested EDTA on radiation recovery and induction of embryo dominant lethals was studied in the wasp Habrobracon. It was found that recovery from temporary sterility induced by x irradiation was retarded in those females which had ingested a meal of the chelating agent prior to the radiation treatment. The amount of dominant lethality induced in the germ cells of irradiated females was significantly increased by treatment with a chelating agent. (auth)

18844

FORMATION OF PHOSPHATE ESTERS FROM PURINE NUCLEOSIDES BY TESTICULAR EXTRACTS FROM X-IRRADIATED RATS. D. A. Rappoport (Baylor Univ., Houston, Tex.). Radiation Research 11, 229-41(1959) Aug.

Testicular extracts from rats treated with 500 r of total-body x irradiation exhibited changes in rates of phosphate ester formation when incubated with inorganic phosphate in the presence of adenosine or guanosine. These changes were noted 24, 72, and 168 hours after irradiation, and they represent extended effects of sublethal x radiation: immediate effects, 30 and 120 minutes postirradiation, were also observed. Some esters were formed at increased rates 24 hours after radiation, particularly when testicular extracts were incubated with guanosine, and subsequent changes in rates were also greater with this substrate. Immediately after radiation rates of phosphate esterification were decreased in presence of either nucleoside. With guanosine the decrease in rates was greater than with adenosine. These rate studies of phosphate esterification by testicular extracts showed that sublethal effects of x rays on enzymatic systems can be detected shortly after irradiation or after extended postirradiation intervals. (auth)

18845

EFFECT OF CONTINUOUS GAMMA IRRADIATION OF MICE ON THEIR LEUKOCYTE COUNTS AND SUSCEPTIBILITY TO BACTERIAL INFECTION. Carolyn W. Hammond, Sonia K. Anderle, and C. Phillip Miller (Univ. of Chicago). Radiation Research 11, 242-52 (1959) Aug.

CF-1 female mice 10 weeks old were exposed continuously to γ-radiation at three dose levels: approximately 34, 72 to 67, and 130 to 127 r/day. Leukocyte counts and red cell volumes were followed, and at intervals susceptibility to bacterial infection was determined by intraperitoneal challenge with graded inocula of Pseudomonas aeruginosa. Increased susceptibility to this infection was related to the rate of irradiation rather than the total amount accumulated. At the lowest dose rate the accumulation of 2140 r during 9 weeks caused practically no increase in susceptibility to this experimental infection. At the next higher dose rate susceptibility began to increase after the third week. It was manifested principally by deaths among mice receiving smaller and smaller inocula of the test microorganism. At the highest dose rate used susceptibility increased more rapidly. The development of leukopenia and anemia was also related to the rate of irradiation rather than the total amount accumulated. (auth)

18846

COMPARATIVE EFFECTS OF INTRAPERITONEAL AND ORAL ADMINISTRATION OF AET ON SURVIVAL OF X-IRRADIATED RATS. Rodney L. Preston, Arthur F. Wells, and Benjamin H. Ershoff (Western Biological Laboratories, Culver City, Calif.). Radiation Research 11, 255-9(1959) Aug.

The effects of intraperitoneal and oral administration of graded levels of AET were determined on the survival of rats exposed to 900 r of total-body x irradiation, a dose which was lethal for unprotected rats. Intraperitoneal administration of AET at a level of 300 mg/kg of body weight shortly before exposure to x irradiation resulted in a highly significant increase in length of survival. When administered by intraperitoneal injection at a level of 400 mg/kg of body weight, however, AET not only failed to increase but actually decreased survival as compared to that of untreated controls. In contrast to the results obtained with intraperitoneally administered AET, oral administration of AET by stomach tube (at levels of 400 or 800 mg/kg of body weight) shortly before x irradiation or mixed in the diet and fed at graded levels (1, 2.5, 5, or 10 gm/kg of diet) prior to and after x irradiation was without significant effect in increasing the survival of x-irradiated rats. (auth)

18847

THE EFFECT OF X-RADIATION ON THE LENS OF THE EMBRYO AND THE ADULT HEN. Antoinette Pirie (Univ. of Oxford). Radiation Research 11, 260-70(1959) Aug.

X irradiation of the chick embryo or of the eye of the young hen does not lead to lens opacity. The immediate radiation damage to the bird lens appears from his-

tological studies to be the same as it is in the mammalian lens, but it is suggested that the damaged cells are lysed from the bird lens whereas they remain in perpetuity in the lens of the mammal. (auth)

18848

EFFECT OF X-IRRADIATION ON THE WEIGHT AND NUCLEIC ACIDS OF THE EMBRYONIC CHICK LENS. K. W. Daisley (Univ. of Oxford). Radiation Research 11, 271-7(1959) Aug.

Ribonucleic acid and deoxyribonucleic acid of the chick lens were measured at intervals during embryonic development. Sublethal x irradiation of chick embryos had no detectable effect on the nucleic acid concentrations in the lenses, either immediately on irradiation or after further periods of incubation. In some experiments, however, a temporary disruption of the weight and ribonucleic acid increases was obtained, so that the irradiated lenses were afterward slightly smaller than normal lenses of the same age and had lower ribonucleic acid contents (but the same concentrations). The radiation, even at its highest sublethal doses, did not cause any visible signs of lens opacities (radiation cataracts) in these experiments. (auth)

18849

CELL RENEWAL AND ACUTE RADIATION DAMAGE. Henry Quastler (Brookhaven National Lab., Upton, N. Y.). Radiology 73, 161-5(1959) Aug.

The relations between radiosensitivity and cell proliferation are complex. Not all proliferating systems are radiosensitive; neither are all radiosensitive systems proliferating. Two phases of cell proliferation are known in some detail: mitosis and chromosome doubling. Both are affected by irradiation in a variety of ways. In addition, irradiation upsets the normal sequence of phases of cell life, and this disturbance leads to a variety of secondary effects. (auth)

18850

POTENTIATION OF X-RAY EFFECTS BY ACTINOMYCIN D. Giulio J. D'Angio, Sidney Farber, and Charlotte L. Maddock (Children's Medical Center, Boston and Harvard Medical School, Boston). Radiology 73, 175-7(1959) Aug.

Radiation responses in normal tissues and certain malignant tumors are enhanced when roentgen irradiation is combined with the intravenous administration of actinomycin D. Normal structures react after smaller doses of radiation than are ordinarily required to produce a like effect, and the healing processes thereafter proceed at a more rapid rate. Actinomycin D alone can reactivate latent radiation effects in tissues which have been previously irradiated but have returned to normal in appearance. The reaction grossly is identical in type and distribution to that produced by the radiotherapy given earlier. Certain neoplasms, some of them notoriously radioresistant, such as malignant melanoma, have shown a favorable response to combined therapy. (auth)

18851

MODIFICATION OF LATE RADIATION INJURY WITH L-TRIIODOTHYRONINE. Arvin S. Glicksman, Rulon W. Rawson, and James J. Nickson (Memorial Center, New York and Sloan-Kettering Inst., New York). Radiology 73, 178-90(1959) Aug.

Sixty-nine patients have been treated for sufficiently long periods to warrant evaluation of the effect of 3,5,3'-L-triiodothyronine (T-3) on established post-irradiation changes. Six patients received only placebo medication. Of the patients with damage existing from two to thirty years, well over half have shown good to excellent response to T-3 therapy. This would indicate that late radiation changes exist in a dynamic state and that it is possible to modify them by altering the metabolism of the damaged tissue. (auth)

18852

INVESTIGATION OF THE RADIOPROTECTIVE EFFECTS OF N-PHENYL SUBSTITUTED AMIDINES OF THE BENZENE, FURAN AND THIOPHENE SERIES ON SUSPENSIONS OF ESCHERICHIA COLI IRRADIATED WITH Co^{60} γ RAYS. S. Todorov and St. Robev (Institut fur Ärztliche Fortbildung, Sofia). Z. Naturforsch. 14b, 383-5(1959) June. (In German)

It is shown that certain aromatic amidines cause a marked radioprotection in the case of E. coli suspensions irradiated with gamma rays. The three compounds tested are: the N-phenylamidine of pyromucic acid (α FA), N-phenylbenzamidine (NPA), and the N-phenylamidine of thiophene-2-carbonic acid (α TA). It is noteworthy that α FA, which exerts a radioprotective effect on E. coli, was found to be a radiosensitizer for S. aureus. (tr-auth)

18853

THE YEAR BOOK OF RADIOLOGY. PART I. RADIOLOGIC DIAGNOSIS. John Floyd Holt and Fred Jenner Hodges, eds. PART II. RADIATION THERAPY. Harold W. Jacox and Morton M. Kligerman, eds. Chicago, The Year Book Publishers, Inc., 1958. 448p.

Representative writings dealing with the effects of gonadal exposure, the actual magnitude of such exposure in the course of various diagnostic procedures, and practicable protective measures were selected for review. Developments in solid-state image amplification and applications of xeroroentgenography in the study of bone specimens are reported. Further evidence has been accumulated on skeletal trauma in infants. Improved radiologic diagnostic procedures are reported for primary pulmonary cancers and pulmonary infarction. Valuable contributions to cardiovascular radiology are summarized. New and greatly improved contrast media have resulted in improved observations during excretory pyelograms and in the visualization of lymphatic channels and lymph nodes. (C.H.)

CHEMISTRY

General

18854 A/CONF.15/P/2471

EKSPERIMENTAL'NOE OPREDELENIE UDEL'NYKH OB'EMOV TYAZHELOI VODY V SHIROKOM DIAPAZONE TEMPERATUR I DAVSENII. (Experimental Determination of Specific Volumes of Heavy Water in Wide Range of Temperatures and Pressures.) Paper presented at the Second U.N. International Conference on the Peaceful Uses of Atomic Energy, 1958. V. A. Kirillin and S. A. Ulybin (U.S.S.R.). 18p.

Investigations were made of the specific volume of heavy water at 100 to 500 atm. and 250 to 500°C. The obtained values are tabulated. (R.V.J.)

18855 AAEC/E-22

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

DETERMINATION OF TRACES OF OXYGEN IN

SODIUM METAL BY INFRARED SPECTROPHOTOMETRY. PART 1. H. J. de Bruin and L. E. Smythe. June 1958. 4p.

The principal methods for the determination of traces of oxygen in sodium are based on the titration of sodium monoxide after the metal has been amalgamated and the oxide filtered off, distilled in vacuum, or reacted with an alkyl halide. (J.E.D.)

18856 AECD-4288

New Brunswick Lab., AEC, N. J.

ANALYSIS OF YTTRIUM OXIDE EXCHANGE SAMPLES. C. J. Rodden. Feb. 1958. Decl. July 24, 1959. $9.30 (ph), $3.60(mf) OTS.

Samples of Y_2O_3 were analyzed as completely as possible in order to see if some correlation could be made between the cross section as measured and the cross section as calculated. Results indicate that it is possible to calculate the cross sections directly from the analytical data with as great a certainty as is obtained in the direct measurements. (W.L.H.)

18857 AECU-4201

Colorado. Univ., Boulder.

THERMOCHEMICAL STUDIES OF ORGANIC FLUORINE COMPOUNDS. Final Report. 72p. Contract AT(11-1)-168. (M-5607). $12.30(ph), $4.50(mf) OTS.

The construction and operation of two calorimeters each using a condensing vapor as the constant temperature bath is described. One was designed to operate at low temperature (that of condensing toluene) and was to be used for measuring heats of elemental fluorination. The second used condensing diphenyl ether and operated at about 248°C. (W.L.H.)

18858 AECU-4244

Los Alamos Scientific Lab., N. Mex.

THE AQUEOUS SOLUBILITY OF UF_4. Albert W. Savage, Jr., and James C. Browne. [1958?]. 9p. Contract [W-7405-eng-36]. $1.80(ph), $1.80(mf) OTS.

The solubility of $2UF_4 \cdot 5H_2O$ was measured at 25°C as a function of added fluoride in mixtures of hydrofluoric and perchloric acids at a constant strength of 0.12 M. Evidence was found for the existence in solution of the species UF_5^-, UF_4°, and UF_3^+. (auth)

18859 AECU-4254

Michigan. Univ., Ann Arbor.

CORRELATION OF POLAROGRAPHIC DATA WITH STRUCTURE. USE OF THE HAMMETT-TAFT RELATION. Report No. 48. Philip J. Elving and Joseph M. Markowitz. Sept. 1, 1958. 12p. Contract AT(11-1)-70, Project 8. $3.30(ph), $2.40(mf) OTS.

The success which the Hammett polar substituent relation has had in correlating the polarographic half-wave potential data of certain series of organic compounds with their structure, prompted an examination of the applicability of the Taft elaboration on the Hammett relation for the same purpose. The Taft-Hammett equation very satisfactorily correlates data on the electrochemical reduction of a variety of functional groups in both aliphatic and aromatic compounds. The equation is not apparently applicable for substituents larger than ethyl groups. Deviation from the predicted behavior is due to the influence of factors in the electrochemical process other than polar effects due to structure. (auth)

18860 AERE-AM-33

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF SILICON IN BERYLLIUM METAL. E. Bowell. June 1959. 7p. $0.25(BIS).

The sample is dissolved in dilute hydrochloric acid in the presence of hydrogen peroxide, and any insoluble matter is fused with sodium carbonate. The dissolved melt is added to the main solution and the silicon is determined absorptiometrically after the formation of the reduced silicomolybdic acid complex. The method is suitable for silicon contents up to 750 ppm. (auth)

18861 AERE-AM-34

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE SEPARATION OF THE MAJOR IMPURITIES IN URANIUM DIOXIDE PRIOR TO SPECTROGRAPHIC EXAMINATION. J. Walkden and K. E. Heathfield. June 1959. 5p. $0.16(BIS).

The sample is dissolved in nitric acid, crystallized, and transferred to a column of activated cellulose. The uranium is removed by elution with ether–nitric acid solvent leaving the impurities on the column which is then ashed and reserved for spectrographic examination. The method is suitable for the separation of Al, Ag, Ba, Be, Bi, Co, Cr, Mg, Mn, Ni, Pb, Si, Sn, Sr, Ti, W, and Zn. (auth)

18862 AERE-AM-35

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF URANIUM IN URANIUM DIOXIDE. J. Walkden. July 1959. 7p. $0.25(BIS).

The uranium is separated from the major impurities in the sample by cellulose chromatography and determined gravimetrically by precipitation with ammonia. The method is suitable for the determination of uranium in electrolytic uranium dioxide and other uranic materials not containing gross amounts of vanadium, molybdenum, thorium, zirconium, and scandium. The error should not exceed ±0.2%. (auth)

18863 AERE-AM-36

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF IRON IN URANIUM DIOXIDE. J. Walkden and K. E. Heathfield. June 1959. 5p. $0.16(BIS).

The sample is dissolved in nitric acid. Any insoluble matter is fused with potassium bisulfate, and the solution from the melt is added to the main solution. Sulfamic acid is added to suppress interference by nitrite. The iron is determined absorptiometrically by the formation of the thioglycollic iron complex in the presence of ammonium carbonate and ammonium citrate. The method is suitable for iron contents up to 350 ppm. The error except in the lowest ranges should not exceed ±5%. (auth)

18864 AERE-AM-37

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF SILICON IN URANIUM DIOXIDE. J. Walkden and K. E. Heathfield. June 1959. 6p. $0.25(BIS).

The sample is dissolved in nitric/hydrochloric acid mixture. Any insoluble matter is fused with sodium carbonate, and the solution from the melt is added to

the main solution. The silicon is determined absorptiometrically by the formation of the reduced silicomolybdic acid complex. The method is suitable for silicon contents of 20 to 1000 ppm. The error except in the lowest range should not exceed ±5%. (auth)

18865 AERE-AM-38

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF VANADIUM IN URANIUM DIOXIDE. July 1959. 6p. $0.16(BIS).

The sample is dissolved in nitric acid and the vanadium extracted as its cupferrate by chloroform. After wet oxidation of the cupferrates the vanadium is determined absorptiometrically as phosphotungstovanadic acid. The method is suitable for vanadium contents from 10 to 4000 ppm. Except at the lower levels the error should not exceed ± 5%. (auth)

18866 AERE-AM-41

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF COPPER IN FUSED MIXTURES OF SODIUM, ZIRCONIUM AND URANIUM FLUORIDES. E. Booth and A. Parker. Apr. 1959. 5p. $0.16(BIS).

The sample is fused with potassium pyrosulfate and the resulting melt dissolved in 0.5 M sulfuric acid. Copper is determined after reduction by reaction with 2:2′ diquinolyl. The copper complex is extracted into n-hexyl alcohol, and the absorbency of the extract is measured at 540 mμ. The method covers the range 2 to 50 μg of copper. The error except in the lowest ranges should not exceed ± 5%. (auth)

18867 AERE-AM-43

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF COMBINED NITROGEN IN BERYLLIUM METAL. J. Walkden. May 1959. 6p. $0.25(BIS).

The nitrogen is converted to ammonium chloride by dissolving the sample in hydrochloric acid and is determined absorptiometrically after distillation of ammonia by the color produced with Nessler's solution. The method is suitable for nitrogen contents up to 400 ppm. (auth)

18868 AERE-AM-44

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF FREE METAL AND CARBIDE CARBON IN BERYLLIUM METAL. J. Walkden. May 1959. 6p. $0.25(OTS).

The sample is dissolved in hydrochloric acid, liberating hydrogen from the metal and methane from the carbide. These are oxidized by copper oxide to water and carbon dioxide which are absorbed in P_2O_5 and Carbest, respectively. The percentage of carbide carbon is calculated from the weight of carbon dioxide, and the percentage of free metal from the weight of water after correcting for the water present from the oxidation of methane. The method is suitable for the determination of free metal in all grades of sample and for carbon contents down to 50 ppm. (auth)

18869 AERE-AM-45

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF CADMIUM IN BERYLLIUM METAL. J. Walkden. June 1959. 6p. $0.25(BIS).

Cadmium and certain other metals are extracted with dithizone from ammoniacal solution. The Cd is separated and determined absorptiometrically as its dithizonate. The method is suitable for concentrations of 0.3 to 10 ppm Cd content. (auth)

18870 AERE-AM-47

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF BERYLLIUM OXIDE IN BERYLLIUM FLUORIDE. J. Walkden. July 1959. 5p. $0.16(BIS).

The sample is dissolved in water and potassium fluoride solution added. This reacts with any beryllium oxide present, liberating an equivalent quantity of potassium hydroxide, which is titrated. The method is suitable for determinations down to 0.05% of beryllium oxide. The difference between the determined percentage and the true content should not exceed 0.05%. (auth)

18871 AERE-AM-49

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF IRON IN BERYLLIUM COMPOUNDS (FLUORIDE, HYDROXIDE AND AMMONIUM FLUORBERYLLATE). J. Walkden. 7p. $0.25 (BIS).

Solutions of the samples are fumed with sulfuric acid to remove fluoride and the residues dissolved in water. The iron content is determined absorptiometrically after formation of the o-phenanthroline complex. The method is suitable for the determination of 5 to 1600 ppm of iron in beryllium fluoride and up to 800 ppm in ammonium fluoberyllate and beryllium hydroxide. Except at the lower levels the error should not exceed ± 5%. (auth)

18872 AERE-AM-50

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.

THE DETERMINATION OF NICKEL IN ZIRCONIUM AND IN ZIRCALOY 2. J. Walkden. July 1959. 6p. $0.16(BIS).

The sample is dissolved in hydrofluoric acid, and after removing the fluoride ion, the nickel dimethylglyoxime complex is formed. This is extracted into chloroform and the nickel back extracted into hydrochloric acid. The oxidized nickel dimethylglyoxime complex is formed, and the nickel is determined absorptiometrically. The method is suitable for the determination of 1 to 1000 ppm of nickel. Except at the lower levels the error should not exceed ± 5%. (auth)

18873 AERE-C/R-1732

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A SPECTROGRAPHIC ABSOLUTE DETERMINATION OF THE NATURAL ABUNDANCE RATIO OF THE LITHIUM ISOTOPES. R. P. Thorne. July 25, 1955. 26p.

Using separated Li^7, a study has been made of the absorption of lithium in lithium vapor. By the use of this data and theoretical considerations, the natural Li^7/Li^6 ratio was found to be 12.5 ± 0.3. To reduce line broadening, a new simple hollow cathode source was designed, constructed, and its memory investigated. The structure of the lithium line 6707 A was resolved by a Fabry-Perot interferometer. (auth)

18874 AERE-C/R-1868

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF URANIUM IN LOW GRADE ORES. F. E. Wild. Mar. 1956. 11p.

A method has been developed which has a general application for the assessment of low-grade uranium ores. A nitric acid solution of the ore, obtained after it has been sintered with sodium peroxide at 450°C, is extracted with ether using a cellulose column. The uranium is concentrated in perchloric acid and determined polarographically. On a sample weight of 1 g, uranium contents of 10 ppm may be assessed with accuracy, and lower amounts can be detected. At a level of 180 ppm the coefficient of variation is ±1.5%, and this precision should not be significantly changed at lower levels. The method is not affected by the presence of gross amounts of any elements except molybdenum. The presence of molybdenum up to at least 0.2% may be tolerated, and procedures are indicated which can be applied to ores of higher molybdenum content. (auth)

18875 AERE-R-2965

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF BERYLLIUM BY THE PHOTONEUTRON METHOD. G. W. C. Milner and J. W. Edwards. June 1959. 26p. $0.56(BIS).

A study was made of a method for the determination of beryllium based on measurement of the photoneutron flux produced on irradiating the sample with photons from a Sb^{124} source. The behavior of many other elements in this determination has been studied in both solid samples and aqueous solutions. Interferences are small, except for some elements with high cross sections for thermal neutrons, including boron, cadmium, samarium, and gadolinium. Large concentrations of deuterium can cause a small positive error due to the 0.2% of 2.3 Mev photons from Sb^{124}. The method has been successfully applied to the determination of beryllia in selected minerals, including hand picked beryls and beryl pegmatites. Concentrate and tailing fraction produced in the mineral dressing treatment of an ore have also been analyzed for BeO content by this method. With suitable samples a considerable saving of time is gained over chemical methods of analysis. Under the best conditions the lower limit of detection of the method is <0.002% BeO. (auth)

18876 AERE-R-2968

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ALKALI PHOSPHOTUNGSTATES. PART V. EXTRACTION OF CAESIUM FROM FISSION PRODUCT SOLUTIONS. T. V. Healy and B. L. Davies. June 1959. 11p. $0.25(BIS).

A number of methods for separating cesium from fission product solutions are reported briefly together with their suitability of application to the Butex Process waste concentrates. The separation of cesium phosphotungstate is described in some detail together with methods of further purification. (auth)

18877 AFOSR-TR-59-89

Syracuse Univ., N. Y.

STUDY OF THE MIGRATION AND DESORPTION OF A DIMORPHIC ADSORBATE USING THE FIELD EMISSION MICROSCOPE: TITANIUM ON TUNGSTEN. Robert C. Abbott and Allan M. Russell. June 1959. 53p. Contract AF49(638)-93.

The migration and desorption of titanium on tungsten was measured by the field emission technique and the activation energies for these processes were determined. In addition, estimates were made for the average number of titanium-titanium and titanium-tungsten bonds broken during migration and desorption. Two distinct migrations were observed: an early stage of migration that took relatively little time to go to completion and a later stage migration with a much longer (~ factor of ten) completion time. The early stage migration has two values of activation energy: 2.4 ± 0.1 ev above T = 847°C and 2.6 ± 0.2 ev below this temperature. The characteristic time necessary for the early stage migration to achieve a given degree of completion changes discontinuously at T = 847°C by a factor of 2.3. The later stage migration activation energy is 2.0 ± 0.1 ev. The desorption activation energy is 6.4 ± 0.2 ev. A possible explanation for this abrupt change in characteristic time, involving the dimorphism of the adsorbate, is discussed. It is postulated that this abrupt change is caused by the excellent fit of the adsorbed titanium layer to the b.c.c. structure of the tungsten substrate when T > 847°C. Pure titanium transforms from a low temperature h.c.p. to a b.c.c. structure at 883°C. Comparison of calculated bond strengths with the experimentally determined activation energies indicates that an average of two Ti-W bonds are broken during early stage migration, while one Ti-W and one Ti-Ti bond are broken during later stage migration. An average of four Ti-W and two Ti-Ti bonds are broken during desorption. (auth)

18878 BM-RI-5481

Bureau of Mines.

TITANIUM ELECTROREFINING: CATHODE STUDIES AND DEEP BATH DEPOSITION. D. H. Baker, Jr. and J. R. Nettle. Oct. 1958. 13p.

The stripped deposit which consisted of titanium metal and occluded electrolyte was weighed, leached with a mechanically agitated solution of water and 5% by volume hydrochloric acid in glass-lined water-cooled tank, washed with demineralized water until free of chloride ion, dried, and sized by screening into +8, −8 + 34, +34 + 48, −48 + 120 and −120 mesh fractions. Samples of the sized fractions were evaluated by chemical analysis and hardness determination. (J.E.D.)

18879 BMI-1360

Battelle Memorial Inst., Columbus, Ohio.

REACTION OF NITROGEN WITH NIOBIUM. William M. Albrecht and W. Douglas Goode, Jr. July 6, 1959. 16p. Contract W-7405-eng-92. $0.75(OTS).

Reaction rates of niobium with nitrogen were determined gravimetrically from 675 to 975°C with a recording microbalance and volumetrically from 1100 to 1600°C with a modified Sieverts apparatus. Diffusion coefficients and terminal solubilities were determined from 800 to 1600°C by the concentration-gradient tech-

nique. The reaction of nitrogen with niobium follows a parabolic rate law at 675 to 1600°C. The expression for the diffusion coefficient for nitrogen in niobium at 800 to 1600°C is given as well as the expression for the terminal solubility for nitrogen in niobium. (auth)

18880 CCC-454-TR-303

Midwest Research Inst., Kansas City, Mo.

THERMAL PROPERTIES OF METHYL BORATE. C. E. Hansen and R. L. Hughes—S. L. Harvey, ed. Feb. 2, 1959. 48p. For Callery Chemical Co. Project ZIP. Contract NOa(s) 58-454-d.

Midwest's physical properties program for methyl borate was continued. Pressure-temperature-enthalpy data are presented together with the Joule-Thomson effect and the heat of vaporization. Thermodynamic charts and tables were prepared from the experimental data, and these data were extrapolated over regions not covered experimentally. (auth)

18881 CF-58-9-93

Oak Ridge National Lab., Tenn.

METHODS FOR THE STUDY OF GAS-METAL REACTIONS IN ULTRA-HIGH VACUUM. G. R. Love. June 30, 1959. 33p. Contract W-7405-eng-26. $6.30 (ph), $3.00(mf) OTS.

A critical review of the methods reported in the literature for the study of gas–metal reactions in high and ultra-high vacuum systems is given. Experimental apparatus and techniques based on volumetric, gravimetric, magnetic, and other properties of the metals including work function, accommodation coefficient, resistivity, and others have been used. A volumetric method, based on a determination of rate-of-reaction, was selected as most readily applicable to the proposed investigation. (auth)

18882 HW-59468

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE MELTING POINTS OF URANIUM DIOXIDE, URANIUM MONOCARBIDE, AND URANIUM MONONITRIDE. H. W. Newkirk and J. L. Bates. Mar. 4, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

The melting points of uranium dioxide, uranium monocarbide, and uranium mononitride are 2700 ± 50°C, 2280 ± 50°C, and 2480 ± 50°C, respectively. The melting point of uranium dioxide was observed to be independent of three methods of fabrication and of the initial O/U ratio in the range 1.95 to 2.36. The melting points agree with the most reliable published values. (auth)

18883 HW-60058

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN AUTOMATIC WATER DEAERATION SYSTEM. J. R. Raymond. Apr. 20, 1959. 7p. Contract [W-31-109-Eng-52]. $1.80(ph), $1.80(mf) OTS.

An automatic water deaeration system was designed and fabricated to provide a continuous supply of deaired water for fluid flow through porous media studies. Air is removed from the water by applying a vacuum on a tank while water is being sprayed into the tank. The system incorporates liquid level controls for the deairing and storage tanks, thus making operation completely automatic. (auth)

18884 IGO-AM/S-47

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF TITANIUM IN URANIUM–TITANIUM ALLOYS. Mar. 11, 1959. 6p.

An aliquot of a nitric acid solution of the alloy is fumed with a controlled volume of sulfuric acid. Titanium is separated as the cupferrate and finally determined absorptiometrically using "Tiron" in a buffered solution. The method is applicable to titanium determinations within the range 0.05 to 0.25% in uranium–titanium alloys. Aluminum (0.1%) is without effect, and 0.1% of iron does not interfere when reduced to the ferrous state. (auth)

18885 IGO-AM/S-133

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF IRON IN BERYLLIUM METAL. Mar. 3, 1959. 6p.

The beryllium is dissolved in sulfuric acid, iron is reduced with hydroxylamine hydrochloride and determined absorptiometrically as its o-phenanthroline complex. The method is suitable for the determination of iron over the range 25 to 250 μg in the aliquot of the sample taken. (auth)

18886 IGO-AM/S-135

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF NICKEL IN BERYLLIUM METAL. Mar. 3, 1959. 6p.

Nickel is separated from the main sample constituents by extraction of its dimethyl glyoxime complex using chloroform. The Ni back extracted from the solvent using HCl, oxidized, and determined absorptiometrically as its dimethyl glyoxime complex. (auth)

18887 IGO-AM/S-152

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF FLUORINE IN BERYLLIUM. Mar. 3, 1959. 8p.

Fluorine, as hydrofluosilicic acid, is steam distilled from sulfuric acid solution of the sample. Be is removed by solvent extraction, and the F is determined absorptiometrically based on the destruction of aluminum/solochromecyanin complex. (J.R.D.)

18888 IGO-AM/S-189

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF BORON IN BERYLLIUM METAL POWDER, SWARF OR FLAKE. Mar. 3, 1959. 8p.

The sample is dissolved in H_2SO_4 in the presence of methanol, and boron separation is effected by distillation as methyl borate. The boron is determined absorptiometrically as the curcumin complex. (auth)

18889 IGR-62(O/S)

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

ANALYTICAL METHOD FOR THE VOLUMETRIC DETERMINATION OF TOTAL HALIDES (EXCLUDING FLUORIDE) IN URANIUM ORES. Mar. 17, 1959. 5p.

The ore is dissolved in nitric acid containing an added excess of standard silver nitrate. The silver halides are filtered off, and the excess of silver nitrate

is titrated using standard ammonium thiocyanate. The method is applicable to uranium ores which contain more than 250 ppm total halides (excluding fluoride). (auth)

18890 IGR-155(O/W)

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
ANALYTICAL METHOD FOR THE GRAVIMETRIC DETERMINATION OF URANIUM IN PLANT SOLUTIONS AND PLANT INTERMEDIATES. May 13, 1959. 5p.

The uranium is precipitated from solutions as ammonium diuranate which is ignited at 900°C, and the U_3O_8 weighed. Solid samples are ignited directly at 900°C. The bias of the method depends on the non-volatile impurity content of the sample. The method is a rapid procedure for the determination of uranium in uranic materials including ammonium diuranate, uranium oxides, and solutions of uranyl nitrate. (auth)

18891 IGR-181(O/W)

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
ANALYTICAL METHOD FOR THE GRAVIMETRIC DETERMINATION OF URANIUM IN URANYL NITRATE SOLUTIONS (AFTER SEPARATION BY ETHER EXTRACTION). June 12, 1959. 6p.

Uranium present in the aqueous sample, after suitable acidity adjustment, is extracted into diethyl ether using a continuous extraction procedure. Water is added to the extract, and the ether is removed by evaporation. The aqueous solution is diluted, and the uranium is precipitated with ammonium hydroxide. The precipitate is filtered off and dried. The dried precipitate is ignited at 900°C, and the uranium is weighed as U_3O_8. (auth)

18892 IS-2

Ames Lab., Ames, Iowa.
PREPARATION OF YTTRIUM FLUORIDE USING AMMONIUM BIFLUORIDE. John Walker and Edwin Olson. July 1959. 23p. Contract W-7405-eng-82. $0.75(OTS).

The preparation of pure UF_3 by reacting U_3O_8 with $NH_4F \cdot HF$ was investigated. A low oxygen intensity UF_3 could not be produced by the methods investigated, and no definite conclusions were drawn. The amount of oxygen in the final metal was not proved to be directly related to the UF_3 oxygen intensity ratio; however, if the oxygen in UF_3 must be reduced to the lowest value, this method of preparation shows little value. (J.R.D.)

18893 ISC-992

Ames Lab., Ames, Iowa.
IONIC MOBILITIES IN SELECTED FUSED SALT SYSTEMS. Boone B. Owens and F. R. Duke. Aug. 1957. 60p. $1.75(OTS).

Transport numbers were determined in the pure fused salts $LiNO_3$, $NaNO_3$, KNO_3, and $AgNO_3$ by measuring the volume changes of the material in the electrode compartments which took place during electrolysis of the melt. Transport numbers in the two binary fused salt systems $AgNO_3-NaNO_3$ and $AgNO_3-KNO_3$ were determined by measuring the volume changes accompanying electrolysis and the concentration changes accompanying electrolysis. The transport numbers of the pure fused salts were found to agree with a radius fraction expression which implied that the mobility of an ion moving through a melt is inversely proportional to its size. It is pointed out that this equation failed for other fused salts, so, factors other than the size must also affect the mobility of the ions in a fused salt. The variation with composition of the cation mobilities in the binary systems studied is discussed in terms of ordered and disordered regions in the melt. (auth)

18894 ISC-1116

Ames Lab., Ames, Iowa.
CHEMISTRY SEMI-ANNUAL SUMMARY RESEARCH REPORT FOR JULY–DECEMBER 1958. Apr. 15, 1959. 68p. Contract W-7405-eng-82. $2.00(OTS).

Physical and Inorganic Chemistry. Pilot plant operations in separation of rare earths using EDTA and HEDTA are reported. Investigation continued on β, β' diaminodiethylether-N,N,N,N-tetraacetic acid as rare earth eluant. Distillation of Sc and Y is described, and purification by filtering rare earth metals slightly above their melting points through a W filter is reported. Melting point data are given for Sc, Gd, Lu, $YbCl_3$, $SmCl_3$, and $CeCl_3$; the heat capacity of Tl and $CrBr_3$ is discussed. Phase studies of La–B, La–Y, Dy–Ta, Tm–Ta, Ni–Y, and Cu–Y were made. The work on acid-base reactions and on the lower oxidation states of Sb continued. The study of relaxation phenomena in the electrical double layer and of the chemical properties of carbon surfaces continued. A study of Cr isotope abundance in chromite ores is discussed. The study of the $Y-H_2O$ (g) reaction is nearly complete. A mass spectrometric study of stannane is described. Pyrometallurgy. Research continued on Pu extraction from U by molten metal with studies using Ag and Mg–Ag. Data are given on the distribution of Pu between V and La. Analytical Chemistry. Work continued on O_2 determination by high-temperature $KBrF_4$ fluorination. The $KBrF_4$ method for O_2 in Y samples was compared with the spectrographic and inert gas fusion methods. Other methods studied are: Nb in presence of Ta by extraction and spectrophotometry, rare earths in Th by ion exchange and spectrophotometry, U by solvent extraction with organophosphorus compounds, U by EDTA titration, Th by photometric titration with EDTA, alcohols and phenols by quantitative acetylation, aliphatic thiols by titration in acetone with Hg^{2+} solution. Spectrochemistry. Studies are reported on: determination of Gd in Y matrices at high sensitivity, O in V metal, and O in YF_3. Radiochemistry. Formation of CdI_2 complexes was studied by extraction into iso-amyl alcohol. Activation analysis of V for C and N using the synchrotron and of Pt for Ir are described. Synthesis procedures for cis $-[Pt(NH_3)_2Cl_2]$ were improved, and the program for computation of the 4 equilibrium constants for successive replacement of chloride ligands in $[PtCl_4]^{2-}$ by bromide was improved. The decay of Sb^{127} was studied. X-ray Chemistry. The structure of M M'-dibromobenzoyl-methane was recalculated. (For preceding period see ISC-1049.) (T.R.H.)

18895 K-1429

Oak Ridge Gaseous Diffusion Plant, Tenn.
DETERMINATION OF THE APPEARANCE POTENTIAL OF THE POSITIVE MOLECULE-ION OF URANIUM HEXAFLUORIDE. V. L. Warren and J. C. Horton. Aug. 12, 1959. 7p. Contract W-7405-eng-26. $0.50 (OTS).

An approximate value of the appearance potential of the UF_6^+ ion was obtained with a conventional analytical mass spectrometer using the vanishing current method. This value was identical with the appearance potential of the UF_5^+, 15 ± 1 volts, within the limits of the accuracy of the measurements. Several determinations of

the latter have appeared in the literature but this is apparently the first report of the UF_6^+ measurement. A more accurate determination of each is still needed. (auth)

18896 LA-2306
Los Alamos Scientific Lab., N. Mex.
THE ANALYSIS OF REFRACTORY BORIDES, CARBIDES, NITRIDES, AND SILICIDES. Owen H. Kriege. Mar. 1959. 58p. Contract W-7405-ENG-36. $1.75 (OTS).

Methods are presented for the analysis of 41 refractory materials. An evaluation of the accuracy and the precision of these techniques are also given. The materials studied are the borides of hafnium, molybdenum, niobium, rhenium, tantalum, thorium, titanium, tungsten, uranium, vanadium, and zirconium; the carbides of hafnium, molybdenum, niobium, silicon, tantalum, thorium, titanium, tungsten, uranium, vanadium, and zirconium; the nitrides of boron, hafnium, niobium, silicon, tantalum, titanium, uranium, and zirconium; the silicides of molybdenum, rhenium, tantalum, titanium, tungsten, vanadium, and zirconium; and mixed carbides of uranium with hafnium, niobium, tantalum, or zirconium. (auth)

18897 LA-2320
Los Alamos Scientific Lab., N. Mex.
PREPARATION OF PITCH-SOLUBLE URANYL-ORGANIC COMPOUNDS. H. R. Baxman, D. D. Jackson, D. L. Williams, and R. J. Bard. May 1959. 18p. Contract W-7405-ENG-36. $0.75(OTS).

Batch processes on a scale of 250 to 300 g of uranium were developed for the production of uranyl oxinate (8-quinolinolate) and uranyl malonate. Both compounds are insoluble in water and were found to be suitably soluble in pitch. Uranyl oxinate was prepared by the reaction of an aqueous uranyl nitrate solution with an acetic acid solution of oxine (8-quinolinol) at about 80°C. Complete precipitation was accomplished by the addition of ammonium hydroxide. Yields of better than 99.5% were obtained. Uranyl malonate was prepared by the reaction of aqueous solutions of sodium malonate and uranyl nitrate at about 80°C in 97 to 98% yield. Uranyl 2-ethylhexanoate was prepared by a transesterification reaction from uranyl acetate and 2-ethylhexanoic acid. Yields of 90% were obtained but the process was quite laborious and time consuming. A metathesis method of preparation was not successful. (auth)

18898 LAMS-2324
Los Alamos Scientific Lab., N. Mex.
A COMPILATION OF THE DEBYE OR CHARACTERISTIC TEMPERATURES FOR ELEMENTS AND COMPOUNDS. A Bibliography. Ruth H. Lier, comp. June 1959. 19p. Contract W-7405-Eng-36. $0.75(OTS).

References found in a search of Nuclear Science Abstracts, Vols. 1-12, Physics Abstracts, Vols. 51-61, and LASL Report Library are given. The subject area was limited to specific heat, heat capacity, elastic constants, thermodynamic properties, and crystal structure. 107 references. (T.R.H.)

18899 MLM-1092
Mound Lab., Miamisburg, Ohio.
THE ADSORPTION OF KRYPTON AND XENON ON ACTIVATED CHARCOAL AND ITS USES IN RESEARCH AND INDUSTRY — A BIBLIOGRAPHY. Lawrence A. Weller. May 6, 1959. 24p. Contract AT-33-1-GEN-53. $0.75(OTS).

A bibliography listing 100 unclassified publications on the adsorption of krypton and xenon on activated carbon and the uses of this adsorption process in research, industry, and in technical applications has been prepared. The period from 1905 to 1959 is covered. The references were selected primarily by means of a search of the abstract literature; then the actual references themselves were examined insofar as they were available. (auth)

18900 MSAR-59-89
MSA Research Corp., Callery, Penna.
PROGRESS REPORT NO. 53 FOR JUNE AND JULY 1959. W. J. Posey, ed. Aug. 14, 1959. 56p. Contract NObs-77023.

Engineering. Research pertaining to reactor coolant problems is reported: unstable film boiling with water in tubes at 1200 and 800 psi, subassembly cooling at decay heat power levels, protective coating evaluation for submarine service, corrosion of bare austenitic piping by sea air, pressure buildup in the vapor container during loss-of-coolant accident, and BTF pressurizer blowdown test. Chemistry. Research is reported on: fission product release during core meltdown, O_2–Na_2SO_3 reaction rates, decontamination studies, and purity, thermal stability and solubility determinations of potassium tetraborate. (See also NP-7252.) (T.R.H.)

18901 NAA-SR-Memo-3843
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THERMO-PHYSICAL PROPERTIES OF OMRE CIRCULATING COOLANT. G. Asanovich. May 7, 1959. 16p. $3.30(ph), $2.40(mf) OTS.

The density, viscosity, and specific heat were determined for OMRE coolant over the temperature range 300 to 800°C and for HB contents ranging from 0.1 to 40.9%. The data were correlated and are graphically presented. Thermal conductivity of OMRE coolant was estimated and is graphically presented. (auth)

18902 NP-6975
Massachusetts Inst. of Tech., Cambridge.
HEAVY WATER PRODUCTION. Lecture delivered at Reykjavik, Sept. 6, 1956. Manson Benedict. [1956]. 65p.

Production and consumption aspects of the heavy water market are discussed. The nature, history, economics, and possibilities for improvement of the most important heavy water production processes are also discussed. (J.R.D.)

18903 NP-7823
North Carolina. Univ., Chapel Hill.
THE MEASUREMENT OF THE INTENSITIES OF INFRARED ABSORPTION BANDS. Final Technical Report [for] period: August 1, 1955 – August 30, 1958. Joseph W. Straley, Robert E. Hiller, Jr., Andrew J. Lavin, Jr., and Roy McKenzie. 86p. DA Project 5B99-01-004. Contract DA-36-034-ORD-2039.

The absolute intensities of fundamental vibration-rotation bands in the infrared spectra of CHD_3, CH_2D_2, CH_3D, CH_2F_2, and $SiCl_3H$ were measured. These measurements were used to compute bond moments and bond derivatives in these molecules. (auth)

18904 NYO-2568
Aeroprojects, Inc., West Chester, Penna.
APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 14 Covering Period from February 1, 1959 to March 31, 1959. Apr. 1959. 45p. Contract AT(30-1)-1836. $7.80(ph), $3.30(mf) OTS.

Several surfactants were evaluated in the ultrasonic agglomeration of KCl aerosol, a simulant for radioactive dispersions. These experimental studies indicate that the extent of coalescence is probably influenced by chemical properties of the aerosols. Multistage equipment for gaseous coalescence was assembled, and preliminary tests indicated it to be more effective than single-stage agglomeration. The tantalum crucible assembly for the ultrasonic extraction of plutonium from uranium with molten magnesium has been received. In preliminary testing of this vessel, at room temperature, microphone measurements revealed a relatively uniform ultrasonic intensity field across the crucible and slightly decreasing intensity from the bottom to the top of the vessel. Additional measurements of the ultrasonic dissolution rate of thorium in mercury showed the rate of attack to be significantly higher at the boiling point of mercury than at lower temperatures. Under the conditions of the experiment, the rate of attack was independent of the exposure time. The rate of ultrasonic erosion of AISI 304 stainless steel in boiling mercury was found to be somewhat lower than the rate at 150°C, confirming the previously observed trend toward reduced erosion rate with increasing temperature. On the basis of current data, it appears that ultrasonic leaching of a simulated alumina waste containing cesium can be effectively accomplished at a power level of 100 watts in 24 hours. Continuous flow treatment was effective, using 0.01 N HNO_3 and a waste-to-leaching liquid ratio of 1:100. Batch treatment was less effective, even at higher power levels. Preliminary work has indicated an increase in the total capacity of an ion exchange resin in a test column operation when ultrasonic energy is applied. In addition, the breakthrough capacity was increased, and the column performed more nearly at equilibrium conditions than in a control run without ultrasonics. (For preceding period see NYO-7934.) (auth)

18905 NYO-7932

Aeroprojects, Inc., West Chester, Penna.

APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 11 Covering Period from August 1, 1958 to September 30, 1958. Oct. 1958. 33p. Contract AT-(30-1)-1836. $4.80(ph), $2.70(mf) OTS.

Continuous aqueous precipitation of thorium oxalate was accomplished using impinging jet streams of the reactants in an ultrasonically activated zone. Evaluation of the influence on resultant particle size was obtained through photomicrographs and centrifugal sedimentation size analysis. Log probability plots showed a significant decrease in particle size and a narrowing of the size distribution for the ultrasonically prepared material as compared to the control. Leaching of a cesium-bearing alumina waste with 0.01 N nitric acid in the presence of vibratory energy was less effective at a frequency of 800 kc than at 20 kc. The effect of treatment time, power level, and ratio of leach liquid to waste was investigated with a 20-kc "fixed-bed" treatment vessel. Leaching efficiency was increased at the higher power levels and the same efficiency maintained when the ratio of waste to acid was increased. Intermittent treatment may be effective, with promise for further equipment economies. Several liquid additive aerosols were evaluated in the ultrasonic agglomeration of KCl aerosol, a simulant for radioactive particulates in calciner off-gas. Silicone oils of several viscosities and two liquid surfactants produced essentially the same degree of agglomeration as the glycerine-water mixture previously used. Development of a larger unit for field test was initiated. Studies of ultrasonic coalescence in stabilized kerosene-water emulsions led to the conclusion that a longer exposure time is indicated. Therefore fabrication was undertaken on a new annular treatment vessel which will permit a two-fold increase in treatment time at the same linear velocity previously found to be near optimum. (For preceding period see NYO-7931.) (auth)

18906 ORNL-2719

Oak Ridge National Lab., Tenn.

PHASE EQUILIBRIA IN THE SYSTEMS UF_4-ThF_4 AND $LiF-UF_4-ThF_4$. C. F. Weaver, R. E. Thoma, H. Insley, and H. A. Friedman. Aug. 31, 1959. 50p. Contract W-7405-eng-26. $7.80(ph), $3.30(mf) OTS.

As part of a study of materials potentially useful as fluid fuels for high-temperature reactors, equilibrium diagrams for the condensed systems UF_4-ThF_4 and $LiF-UF_4-ThF_4$ were determined. Both thermal analysis and quenching techniques were used, with phase identification accomplished by petrographic and x-ray-diffraction analysis. A complete series of solid solutions without maximum or minimum is formed by UF_4 and ThF_4. (auth)

18907 PAL-59-3

SOVIET RESEARCH IN LUBRICANTS AND LUBRICATION. Dec. 1, 1958. 28p. $0.75(OTS).

This study was concerned mainly with what is being done in the USSR and its satellites in lubrication for use at the extremes of temperature and other operating conditions such as environment, pressure, and bearing materials. The survey is based on abstracts published in the American Chemical Society's Chemical Abstracts and in the Universal Oil Products Company's Library Bulletins of Abstracts. (W.L.H.)

18908 R58AGT333

General Electric Co. Flight Propulsion Lab. Dept., Cincinnati.

BIBLIOGRAPHY ON SURFACE IONIZATION. G. Kuskevics. May 12, 1958. 19p.

A bibliography on ionization of atoms and molecules at incandescent surfaces is presented. References cover a period from about 1920 to the present. (J.R.D.)

18909 RDB(C)/TN-83

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.

A CRITICAL REVIEW ON THE CHEMISTRY AND EXTRACTION OF VANADIUM. C. Tyzack. July 1, 1954. 41p.

A review was made of the sources of vanadium, the important vanadium-bearing minerals, and their location. Special attention has been paid to sources available to the United Kingdom from the Sterling Area. Methods of extraction and reduction of vanadium compounds were considered, and three alternative routes for the production of ductile vanadium are proposed. The physical and chemical properties of pure vanadium have been discussed. (auth)

18910 RDB(S)/TN-2060

Gt. Brit. Springfields Works, Springfields, Lancs, England.

ION EXCHANGE APPLIED TO RECOVERY OF URANIUM FROM SPRINGFIELDS' CALCIUM FLUORIDE REACTION SLAG. J. O. Ware. Apr. 1953. 18p. (SRSC/P-15).

Uraniferous liquor obtained by leaching Springfields'

calcium fluoride reaction slag with 10% sulfuric acid containing manganese dioxide oxidizing agent was stripped of uranium by single column and multiple column ion exchange operations. The work was done on a laboratory scale using Dowex-1, a strong-base resin, in the nitrate form, which absorbs uranium as an anionic sulfate complex, giving effluents at 5 ppm and less. The saturated columns were eluted individually with ammonium nitrate/nitric acid solution and the uranium precipitated from the eluate as ammonium diuranate. Samples of ammonium diuranate were analyzed for B, Fe, Ca, Si, and F. Effluent curves for a multiple column run were obtained by plotting uranium in effluent against volume throughput, and the concentration gradient determined. (auth)

18911 RISLEY-5057/2

Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.

THE DISSOLUTION OF CAST URANIUM RODS IN 3N NITRIC ACID CONTAINING 0.3GM. URANIUM PER MILLILITRE. (Second Interim Report). J. H. Tonkin. Feb. 16, 1949. 22p.

On the basis of information obtained from laboratory experiments, work has been carried out on a 20 liter scale to establish the rate of dissolution of uranium on a continuous basis such as to yield a liquor containing 0.3 g of uranium per ml in 3 N nitric acid and to provide information for a larger scale trial on a one-third production scale plant. (auth)

18912 RISLEY-8092-D

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.

LIQUID-VAPOUR EQUILIBRIA IN BINARY SYSTEMS INVOLVING URANIUM HEXAFLUORIDE AND SOME HALOGEN FLUORIDES. J. F. Ellis. May 1954. 13p.

Liquid-vapor equilibria in the system UF_6-ClF_3 at 67°C and (in part) 84°C have been investigated. Complete miscibility is exhibited at the lower temperature over the whole composition range and at the higher temperature up to 0.565 mol. fraction Hex. Mixtures with smaller quantities of Hex than this were not studied at the higher temperature due to the high pressure hazard. Liquid vapor equilibria in the system UF_6-BrF_5 at 68 and 80°C were investigated. The components are completely miscible and the results indicate the formation of an azeotrope of maximum total vapor pressure of approximate composition 0.1 mol. fraction Hex. An attempt has been made to study liquid-vapor equilibria in the system UF_6-BrF_3 at 82°C. The incomplete results obtained indicate that it should be possible to separate these compounds by simple distillation. (auth)

18913 SCS-M-1A

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF URANIUM IN HIGH GRADE ORES BY THE ETHER EXTRACTION METHOD. Mar. 21, 1952. 11p.

The sample is dissolved in nitric acid and the uranium separated by continuous ether extraction. After removal of iron and conversion of uranium to sulfate, the U(IV) is titrated with potassium dichromate. The method has been used for ore containing from 10 to 80% U_3O_8. (auth)

18914 SCS-M-35

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF URANIUM TETRAFLUORIDE IN MAGNESIUM REDUCED SLAGS. July 23, 1954. 4p.

The UF_4 is selectively dissolved from the slag by means of a solution of ethylenediaminetetraacetic acid and boric acid. The U(IV) is determined volumetrically using potassium dichromate. (auth)

18915 SCS-M-59

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF TOTAL CALCIUM AND TOTAL MAGNESIUM IN MOULD LINING (CALCIUM OXIDE). Apr. 16, 1952. 7p.

Calcium is precipitated with ammonium oxalate solution, ignited, and weighed as calcium carbonate; magnesium is precipitated with ammonium phosphate solution and is then ignited and weighed as magnesium pyrophosphate. The process is suitable for a concentration of >1% magnesium. (auth)

18916 SCS-M-65A

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF SILICON IN MOULD LINING (CALCIUM FLUORIDE). July 13, 1953. 6p.

The sample is dissolved in a mixture of aluminum chloride and hydrochloric acid and the solution filtered. The residue is fused with sodium hydroxide, leached with water, and after acidifying, aluminum chloride added. The silica is determined absorptiometrically as molybdenum blue complex on both these solutions. The method is suitable for the determination of silicon over a range 25 to 5000 ppm. (auth)

18917 SCS-M-151

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF CADMIUM IN CALCIUM FLUORIDE. Jan. 26, 1949. 8p.

Fluorine is removed by treatment with a mixture of HCl and $HClO_4$. The Cd is extracted from the residue as Cd dithizonate and determined absorptiometrically. (auth)

18918 SCS-M-269

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF NIOBIUM IN NIOBIUM METAL, MIXED OXIDES OF NIOBIUM AND TANTALUM, POTASSIUM FLUONIOBATE AND NIOBIUM CHLORIDES. Aug. 31, 1954. 5p.

The niobium is determined by a differential colorimetric technique in solutions containing a controlled fluoride content. The complexing agent is pyrogallol stabilized with sodium sulfite. The method may be applied to samples low in iron, titanium, molybdenum, and tungsten (1% each) and free from polybasic organic acids such as oxalic and tartaric acids. The final sample used for the actual colorimetry should contain 500 to 800 μg and the precision is expected to be of the order of ± 1% (3 × standard deviation). (auth)

18919 SCS-M-309

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF RARE EARTHS IN HYDROGEN PEROXIDE. May 1, 1950. 21p.

The sample is decomposed by warming in the presence of Pt and evaporated to low bulk. The rare earths

are separated by precipitation as oxalates with Ca as a carrier followed by precipitation with a standard amount of ferric hydroxide. After ignition the oxides are examined spectrographically. (auth)

18920 SCS-M-316

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF LITHIUM, POTASSIUM AND BARIUM IN CALCIUM BASE MATERIALS BY CARRIER DISTILLATION. Apr. 24, 1950. 10p.

The calcium metal or compound after conversion to the high bulk density oxide is mixed with 7% of its weight of pure sodium chloride and placed in a deep graphite cup. It is then heated in a d-c arc at 10 amps when the sodium chloride distils accompanied by the alkali metals, leaving the bulk of the calcium oxide behind in the cup. The arc is aligned with a Hilger large automatic glass/quartz spectrograph, using the glass train, and the spectrum recorded on a photographic plate in the usual manner, the resultant plate being examined visually in a comparator or for greater accuracy the density of the lines are measured using a Hilger non-recording microphotometer. (auth)

18921 SCS-M-329

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION (CONCENTRATION) OF ALKALI METALS IN ALUMINIUM SULPHATE. July 4, 1950. 3p.

The sample is ignited to oxide, and the alkali metals are leached out with hydrochloric acid. The resulting solution is submitted for spectrographic examination by the Lundegardh technique. (auth)

18922 SCS-M-342

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF MAGNESIUM IN URANIUM METAL. Sept. 18, 1950. 11p.

The magnesium is concentrated on a column of activated cellulose, and after removal of all the uranium from the column, the magnesium is eluted with a solution of ammonium hydroxide/ammonium nitrate and is estimated by the iron flux spectrographic technique. The method is applicable for magnesium concentration of 1 to 50 ppm. (auth)

18923 SCS-M-364

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF THORIUM IN T.B.P. PHASES. Jan. 11, 1955. 4p.

The thorium is determined directly on an aliquot of the sample in the presence of water by titrating the pyrocatechol violet complex with excess standard ethylenediaminetetraacetic acid, the thorium being extracted into the water layer by stirring with a glass rod. The excess ethylenediaminetetraacetic acid is then back titrated with standard thorium solution. (auth)

18924 SCS-M-398

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION (CONCENTRATION) OF VANADIUM, TITANIUM, TIN, ZIRCONIUM AND MOLYBDENUM IN URANIUM METAL, URANIUM HEXAFLUORIDE AND URANIUM TETRAFLUORIDE. June 12, 1955. 6p.

The sample is fumed with sulfuric acid to convert uranium present to uranyl sulfate. The cupferrates of the trace elements are extracted with chloroform. The chloroform is removed and the trace elements concentrated on to a known weight of ferric oxide and submitted for spectrographic examination by the iron flux technique. (auth)

18925 SCS-Memo-55

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF TITANIUM IN NIOBIUM: THE PEROXIDE METHOD. R. Dickinson and J. A. Ryan. Aug. 25, 1955. 14p. (ARDC/P-125).

A spectrophotometric study was made of the peroxide method for the determination of titanium in niobium metal. It has been confirmed that in oxalic acid–sulfuric solution, the absorbency peak of the peroxide complex occurs at 390 mμ, as against 410 mμ in the presence of sulfuric acid alone. At both wavelengths, the system obeys the Beer-Lambert Law and the method can be used for the determination of titanium in pure niobium. The effects of molybdenum, vanadium, and iron were examined and found to be such as to almost prohibit their presence where titanium is sought at the ppm level. (auth)

18926 SCS-R-1

Gt. Brit. Springfields Works, Springfields, Lancs, England.

SPECTROGRAPHIC DETERMINATION OF ERBIUM. July 21, 1948. 5p.

With the lines and comparisons given, it should be possible to estimate erbium visually provided it is concentrated by the normal rare earth concentration procedure. With a limit reading of < 0.003% with respect to flux of erbium it is possible to achieve a limit of detection of < 0.01 ppm on the normal quantity (20 g) of uranium taken. Interferences with other rare earths lines by erbium lines are such that at least for the present it is undesirable for erbium to be incorporated into the standard plates of either mixture I(Ce, Eu, Gd, Tb, Ho, Yb, and Lu) or mixture II (Nd, Pr, Sm, La, Sc, Yt, and Dy). Thus the lines at present in use for Ho and Yb in Mixture I and Dy, Pr, and Nd in mixture II would be interfered with. (auth)

18927 SCS-R-3

Gt. Brit. Ministry of Supply. Chemical Inspectorate, London.

DETERMINATION OF LEAD IN URANIUM METAL. A. B. Crowther. 1948. 5p.

A rapid method for the determination of lead in uranium was developed provided the metal is not grossly contaminated with metals which react with dithizone. The lead is separated by extraction with dithizone in chloroform in presence of citrate, hydroxylamine hydrochloride, and potassium cyanide from a solution of the metal made alkaline with ammonia to litmus. The extract is washed with cyanide-ammonia solution and, if thallium is present, with dilute cyanide. The lead dithizonate can then be estimated colorimetrically. (auth)

18928 SCS-R-17

Gt. Brit. Springfields Works, Springfields, Lancs, England.

REPORT ON THE USE OF THYMOL AS A REAGENT

FOR THE ABSORPTIOMETRIC DETERMINATION OF TITANIUM WITH PARTICULAR REFERENCE TO URANIUM. A. B. Crowther. Nov. 8, 1948. 7p.

Titanium may be determined absorptiometrically using thymol. This colorimetric finish may be applied to the determination of titanium in uranium solutions after its separation by extraction of its chloroform soluble cupferride. In pure uranium solutions interference by other metals is unlikely, but nitric acid, nitrous acid, and peroxides interfere with the thymol color and must be removed. The color of the thymol-titanium complex is several times as intense as that formed by titanium and hydrogen peroxide. (auth)

18929 SCS-R-20

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE ESTIMATION OF SILICON IN PURE URANIUM PEROXIDE. A. E. Sawyer. June 21, 1949. 6p.

An absorptiometric method for the estimation of silicon in pure uranium peroxide by the reduction of silicomolybdic acid to "molybdenum blue" after the removal of peroxides with sodium nitrate is described. (auth)

18930 SCS-R-21

Gt. Brit. Springfields Works, Springfields, Lancs, England.

REPORT ON THE DETERMINATION OF CADMIUM IN CALCIUM FLUORIDE. A. B. Crowther and F. Warburton. Nov. 18, 1948. 6p.

It was not possible to develop a general method for the determination of cadmium in calcium fluoride. The effects of various other impurities, particularly lead, were not overcome, and their effect is to hinder the isolation of the cadmium. No difficulty was experienced in separating cadmium from pure calcium solutions. Although the results were of a negative type, the investigation brought to light a serious deficiency in the existing methods for cadmium and shows that the principles underlying the behavior of metal dithizonates are not yet fully understood. (auth)

18931 SCS-R-28

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF WATER IN URANIUM TETRAFLUORIDE BY THE FISCHER METHOD. F. J. Armson, R. E. Worthington, H. E. Dibben, and G. S. Towler. Aug. 15, 1949. 10p.

The Fischer method for the determination of water has been satisfactorily applied to uranium tetrafluoride, using a polarization end point. A shortened method, using direct titration to a visual end point, where a lower order of accuracy is adequate, is included in the report. (auth)

18932 SCS-R-30

Gt. Brit. Springfields Works, Springfields, Lancs, England.

AN INVESTIGATION INTO THE FORMATION AND COMPOSITION OF AMMONIUM DIURANATE BY POTENTIOMETRIC TITRATION OF URANYL SALTS WITH AMMONIUM HYDROXIDE. F. J. Armson, H. E. Dibben, and H. Mason. July 20, 1949. 7p.

Analysis of the product obtained by the precipitation of uranyl nitrate with ammonium hydroxide, in the Springfields process, indicated that its composition did not correspond to the formula $(NH_4)_2U_2O_7$, normally ascribed to it. The proportion of ammonium ion in the product was found to be less than the 5.77% required by this formula. By potentiometric titration of uranyl solutions with ammonium hydroxide, the composition of intermediate and final products has to some degree been indicated. (auth)

18933 SCS-R-31

Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.

THE DETERMINATION OF OXYGEN IN MIXTURES OF NITROGEN AND ETHER VAPOUR. M. G. Hall, R. M. Lees, J. Mortimer, J. A. Ryan, and A. L. Brophy. Mar. 1, 1950. 21p.

Methods were investigated for the determination of oxygen in admixture with nitrogen and ether vapor. The methods described fall into three sections: colorimetric, gasometric, and titrimetric. A colorimetric method was devised which depends on the formation of the blue cupric-ammonium chloride complex and the comparison of this color against a standardized indicator. The method is applicable only to concentrations of less than 1% oxygen and is too slow to operate for plant control. A titrimetric method is described whereby, after oxidation, excess cuprous copper is stabilized by acidification with acetic acid and the cupric copper determined iodometrically. The latter method has a precision of 0.07% oxygen over the range 0-4% and is sufficiently rapid for plant control. (auth)

18934 SCS-R-39

Gt. Brit. Springfields Works, Springfields, Lancs, England.

DETERMINATION OF SULPHATE IN CRUDE URANIUM PEROXIDE PASTE. J. Barraclough and C. S. Wilkie. June 2, 1949. 8p.

The following method of solution was finally adapted, 2 gm of uranium peroxide were dissolved in 3 ml of 1:1 hydrochloric acid measured by a pipette. The solution was boiled 3 minutes to remove hydrogen peroxide. 0.880 ammonia was added till a slight permanent precipitate formed. This was dissolved in varying amounts of 1:1 hydrochloric acid and sulfate determined. (auth)

18935 SCS-R-49

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE CHROMATOGRAPHIC CONCENTRATION AND THE SPECTROGRAPHIC DETERMINATION OF CADMIUM IN URANIUM METAL. J. E. Dunabin, H. Mason, A. P. Seyfang, D. Trappe, and F. J. Woodman. May 1950. 30p. (SCS-R-127; SCS-R-140).

A method of chromatographic treatment of mixed dithizonate complexes has been devised whereby partial separation of some is effected upon an alumina column. Special attention has been devoted to the cadmium dithizonate complex which has been concentrated in the first centimeter of a column prior to direct spectrographing of the alumina. Exploratory work is described dealing with the potential estimation of trace metals adsorbed as dithizone complexes on alumina by direct spectrographic examination. Details are given of the experimental work leading to the development of a method for the determination of small amounts of cadmium and its application to the determination of cadmium in uranium. (auth)

18936 SCS-R-71

Gt. Brit. Springfields Works, Springfields, Lancs, England.

PREPARATION OF PURE SILVER CHLORIDE FOR USE AS A SPECTROGRAPHIC CARRIER. G. B. Sheard. June 9, 1949. 4p.

It has been found that silver chloride of the purity re-

quired by the carrier distillation method and which can be ground to a fine powder can be prepared using silver nitrate of A.R. quality as a starting material. (auth)

18937 SCS-R-108

Gt. Brit. Springfields Works, Springfields, Lancs, England.

ABSORPTIOMETRIC DETERMINATION OF IRON IN URANIUM AND ITS COMPOUNDS. URANIUM METAL, AMMONIUM DIURANATE AND URANOUS FLUORIDE (AFTER REMOVAL OF FLUORINE). A. B. Crowther, F. Warburton, R. Dickenson, and S. M. Dykes. Mar. 30, 1950. 7p.

The possibility of determining microgram quantities of iron in uranium solutions using thioglycolic acid and ammonia without a prior separation from uranium has been studied and a method proposed. Citrate and carbonate ions are employed to prevent precipitation of uranium and destroy the color due to uranium and thioglycolic acid, respectively. Solutions containing uranyl ions do not absorb light at 5350 A which corresponds to maximum absorption for iron thioglycolate. Cobalt interferes and as yet the method can only be applied where this metal is absent or present in relatively small quantities. The method has been successfully applied to solutions of uranium metal (in nitric acid), ammonium diuranate, and uranium tetrafluoride after removal of fluorine. (auth)

18938 SCS-R-142

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF CHROMIUM, MANGANESE, NICKEL, TITANIUM AND VANADIUM IN ALUMINIUM SULPHATE. J. E. Dunabin and J. Rose. June 19, 1950. 9p.

A procedure including concentration of the required impurities followed by iron flux spectrography is described for determination of Ni, Cr, Mn, Ti, and V. The lower estimation limit is 5 ppm. (J.R.D.)

18939 SCS-R-176

Gt. Brit. Springfields Works, Springfields, Lancs, England.

RAPID DETERMINATION OF NICKEL IN URANIUM METAL. A. B. Crowther. Mar. 25, 1950. 10p.

A rapid method for the determination of nickel in uranium metal has been devised. Separations are avoided, a filter being selected which allows light to pass through uranium solutions with very little absorption, but which permits maximum absorption by nickel dimethyl glyoxime. Elements which might interfere normally are not present in sufficient quantities to cause significant error. (auth)

18940 SCS-R-196

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF MAGNESIUM IN URANIUM, PRECEDED BY CONCENTRATION ON A CELLULOSE COLUMN. A. P. Seyfang and D. Trappe. Nov. 29, 1950. 18p.

An account of experimental work which led to the development of a satisfactory method for the spectrographic determination of magnesium in uranium is given. The method finally adopted consists of concentrating the impurities in uranium on a column of activated cellulose, the uranium being removed by 5% nitric acid/ether solvent. The magnesium is then eluted by means of a solution of ammonia/ammonium nitrate, and is determined by the normal iron flux spectrographic technique using a standard plate and line-pair equalities. (auth)

18941 SCS-R-272

Gt. Brit. Springfields Works, Springfields, Lancs, England.

CONCENTRATION OF LITHIUM, SODIUM AND POTASSIUM IN FERROUS SULPHATE PRIOR TO SPECTROGRAPHIC ANALYSIS. P. C. Palin and R. Franklin. July 19, 1951. 9p.

The iron is removed electrolytically from an acid solution of ferrous sulfate, using a mercury cathode apparatus. The solution remaining after electrolysis is evaporated to remove excess acid and then spectrographed by the Lundegardh technique. The lithium, sodium, and potassium are determined microphotometrically. (auth)

18942 SCS-R-367

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF URANIUM DIOXIDE IN URANIUM TETRAFLUORIDE. J. A. Ryan and A. R. Spencer. Sept. 10, 1954. 11p. (ARDC/P-30).

In a previous report it was shown that while uranium tetrafluoride is soluble in EDTA–boric acid solution, uranium dioxide is relatively insoluble, thus permitting the determination of uranium tetrafluoride in the presence of uranium dioxide. The same method has now been extended to determine uranium dioxide in uranium tetrafluoride at low levels. It was shown that a small proportion of uranium dioxide is soluble in the reagent and the solubility loss is slightly greater for unstabilized uranium dioxide than for stabilized material. The uranium in solution is not quadrivalent. Mechanical grinding of the sample before analysis shows loss of uranium dioxide, and again this is somewhat more noticeable with unstabilized uranium dioxide. A comparison of the results obtained on a limited set of samples by a bromine trifluoride method and the present one shows the presence of oxygen containing compounds other than uranium dioxide, uranyl fluoride and moisture. Hence, the bromine trifluoride result cannot in all cases be used to calculate the uranium dioxide content of uranium tetrafluoride. (auth)

18943 SCTM-139-59(16)

Sandia Corp., Albuquerque, N. Mex.

THE RADIATION CHEMISTRY OF ORGANIC DYES. W. H. Cropper. July 29, 1959. 30p. $1.00(OTS).

The general features of the solution radiation chemistry of dyes are considered in a review of the important work in this field. For methylene blue, the dependence of the decolorization yield on the following is discussed: (a) the presence or absence of dissolved oxygen; (b) the presence of organic and inorganic added solutes; (c) the presence of impurities; (d) changes in energy and dose rate of the radiation; and (e) changes in pH. Also for methylene blue, the equations developed in earlier work by the author are applied to many of the above situations. The radiation chemistry of numerous other dyes is also considered. A section is included which develops a viewpoint concerning the oxidizing and reducing power of radicals in solution, based on the calculation of oxidation potentials, and applications are made to organic dye systems. Remarks are also made concerning the effect of pH and nonaqueous solvents on

the mechanisms involved in the radiation decomposition of dyes. (auth)

18944 UCRL-3405

California. Univ., Berkeley. Lawrence Radiation Lab.
PSYCHROMETRIC STUDIES AT EXTREME HUMIDITIES (thesis). Loren Jens Hov. June 1959. 63p. Contract W-7405-eng-48. $1.75(OTS).

To determine the effect of the film-pressure factor on the psychrometric ratio in the air – water-vapor system, wet- and dry-bulb determinations were made over a range of film-pressure factors from 0.941 to 0.0865. When the film-pressure factor did not deviate far from unity the data agreed with the expression of psychrometric ratio by Lynch and Wilke: $k_G M_m p_f/h$ $C_p = 0.93\ [(C_p\mu/k)/(\mu/\rho D)^{2/3}]$. In this expression the heat-transfer coefficient h was corrected for simultaneous mass transfer according to the Ackermann correction as extended by Mickley and associates. The data disagree sharply as the film-pressure factor is reduced. At values of p_f below 0.7 the disagreement exceeds 10%, and exceeds 90% at $p_f = 0.1$. The above equation would more nearly agree with the data if the film-pressure factor entered to the zero power, but no simple power function can adequately explain the data. Further psychrometric work on other systems is needed to express the dependence on the film-pressure factor, and until this is accomplished a plot of psychrometric ratio versus film-pressure factor is offered for psychrometric calculations for the air-water-vapor system. (auth)

18945 UMAEC-5-1955-1

Michigan. Univ., Ann Arbor.
LOW TEMPERATURE PHASE BEHAVIOR AND THERMAL PROPERTIES OF THE SYSTEMS NaF–HF AND NH_4F–HF. LOW TEMPERATURE THERMODYNAMIC FUNCTIONS OF TITANIUM TETRAFLUORIDE (thesis). Robert D. Euler. 1954. 84p. Project No. 5. Contract AT(11-1)-70. $13.80(ph), $4.80(mf) OTS.

18946 WADC-TR-57-45(Pt. III)

Thiokol Chemical Corp. Reaction Motors Div., Denville, N. J.
HIGH-TEMPERATURE STABLE SEMIORGANIC FLUIDS. PART III. PHOSPHINE OXIDES. Period [covered]: April 15, 1958 to February 15, 1959. Daniel Grafstein, Rita Dudak, and Murray S. Cohen. Mar. 31, 1959. 50p. Project No. 7023. Contract AT33(616)-5653.

The heretofore undescribed organophosphonyl fluorides were prepared and characterized. Unlike the corresponding chlorides, the organophosphonyl fluorides condense smoothly with organometallic reagents to give very high yields of the tertiary phosphine oxides. This represents a new one-step general synthesis of the phosphine oxides. Benzenephosphonyl difluoride, chloromethylphosphonyl difluoride and phenyl p-tolylphosphonyl fluoride were prepared for the first time and used as intermediates to the following phosphine oxides: triphenylphosphine oxide, phenyl-bis(p-biphenyl)-phosphine oxide, phenyl-bis(p-tolyl)-phosphine oxide, chloromethyldiphenylphosphine oxide, phenyl-o-tolyl-p-tolylphosphine oxide and phenyl-dimethylphosphine oxide. The thermal stabilities of the phosphine oxides were measured by an improved kinetic method. Phenyl-bis(p-biphenyl)-phosphine oxide was found to be thermally stable at 400°C and to undergo rapid thermal decomposition at 448°C. (auth)

18947 WADC-TR-59-251

Du Pont de Nemours (E. I.) & Co. Eastern Lab. Gibbstown, N. J.
SYNTHESIS OF THERMALLY STABLE INORGANIC AND SEMI-INORGANIC BASE FLUIDS. John A. Parkins. June 1959. 44p. Project Nos. 1428 and 7340. Contract AF33(616)-5843.

The purpose of this study has been the synthesis and preliminary evaluation of inorganic, semiorganic, or organometallic compounds possessing extraordinary thermal stability and a wide liquid range as prototypes for base-stock fluids useful at 1000°F (538°C) as lubricants, greases, and hydraulic fluids. A means of converting crystalline fractions of phosphorus nitrilic chloride to liquid fractions was developed. Fluoride was substituted for the chloride of the liquid fractions of the polymer, but the product boiled too low to be of interest. Attempts to prepare other derivatives of the liquid polymer were unsuccessful. Attempts to prepare the arsenic and antimony analogs of phosphorus nitrilic chloride were generally unsuccessful; however, a trace quantity of elastic polymeric material was obtained from the reaction of antimony pentachloride and ammonia, and tentative identification was made of an antimony-nitrogen structure in this material by infrared spectral studies. Antimony incorporated in phosphorus nitrilic chloride produced a significant reduction of the polymerization tendency of this polymer. A phenyl "stiboxane" was prepared from antimony oxide and partially characterized. Several phenyl stibine derivatives were prepared and given preliminary thermal screening. Initial attempts to prepare methyl cacodylate were unsuccessful. General relationships as guides for selection of low-melting eutectic mixtures were formulated and the zone-melting method was adapted for screening systems for low-melting compositions. A shear-modification method for reduction of the softening point and viscosity of glasses was proposed, but preliminary trials were hampered by mechanical difficulties. (auth)

18948 AAEC/E-19

A NEW ION EXCHANGE METHOD FOR THE DETERMINATION OF URANIUM IN PHOSPHATE ROCKS, COAL ASHES, BAUXITES ETC. J. Korkisch, A. Farag, and F. Hecht. Translated by H. M. J. Meyer from Z. Anal. Chem. 161, 92-100(1958). 14p.

The simple, rapid, and quantitative ion exchange method described makes it possible to determine with great accuracy uranium in phosphate rocks, coal ashes, bauxites, etc., using a single column process. Uranium forms a negatively charged uranium(VI) chloride complex in a 4N hydrochloric acid solution containing ascorbic acid, which is adsorbed quantitatively on the strongly basic anion exchanger "Amberlite" IRA-400 (Cl^-) in contrast with most other elements. After rinsing the resin with 4N hydrochloric acid, which contains ascorbic acid, the uranium is then extracted with 1N hydrochloric acid. The uranium in the extract is determined polarographically using the catalytic nitrate wave or fluorimetrically. Results from this method compare favorably with those from methods in current use. (auth)

18949 AEC-tr-3748

SOLUBILITY OF FERRIC CHLORIDE AND ITS ALLOYS WITH NIOBIUM, ALUMINUM, AND SODIUM CHLORIDES IN TITANIUM TETRACHLORIDE. I. S. Morozov and D. Ya. Toptygin. Translated for Los Alamos Scien-

tific Lab. from Zhur. Neorg. Khim. 2, 2129-35(1957). 10p. $1.80(ph), $1.80(mf) JCL or LC.

Data are presented tabularly; phase diagrams are included. Also included are data obtained in a study of the $FeCl_3$–NaCl system throughout the concentration range and from a study of the TiCl–$FeCl_3$–NaCl system. (J.R.D.)

18950 AEC-tr-3756

SPECIFIC WEIGHT OF AQUEOUS SOLUTIONS OF FORMIC AND ACETIC ACIDS. A. A. Glagoleva. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Obshcheĭ Khim. 15, 131-4(1945). 7p. $1.80(ph), $1.80(mf) JCL or LC.

Determinations of the specific weights of aqueous formic and acetic acid solutions were made. The data are presented tabularly and graphically. It is noted that the specific weight isotherm of the system formic acid–water has maxima in specific weight values at 20 and 25°C, the larger being at 20°C. The acetic acid–water system also has two maxima. Two stable water systems were observed in both the acetic acid and formic acid, one containing a single molecule of water and one with two water molecules. (J.R.D.)

18951 CEA-tr-A-583

CRITIQUES SUR LES DÉTERMINATIONS DE GROSSEUR DES GRAINS PAR TAMISAGE, PROCÉDÉ PNEUMATIQUE, SÉDIMENTATION ET PAR L'ESSAI DE BLAINE. (Critiques on Size Determinations of Grains by Screening, Pneumatic Procedures, Sedimentation, and the Blaine Test.) W. Batel. Translated into French from Chem. Ingr. Tech. 29, 581-9(1957). 28p.

The precision of analysis by screening depends mostly on the operation of the machine, especially for sizes below 60 μ. The pneumatic and sedimentation methods effect a satisfactory degree of separation. For materials between 30 and 100 μ a screen with an air current should be used. For grains of 1 to 60 μ sedimentation gives exact values when the particle dispersion is correct. Experimental results using these methods are compared. (T.R.H.)

18952 CEA-tr-R-660

ETUDE DE LA RÉSISTANCE À LA CORROSION DES SOLUTIONS SOLIDES DE MÉTAUX. V. SYSTÈME Cu-Ni. (Study of the Corrosion Resistance of Solid Solutions of Metals. V. The Cu–Ni System.) N. N. Gratzianskii (Gratziansky) and I. A. Gutzev (Goutzev). Translated into French by B. de Trezvinsky from Zhur. Fiz. Khim. 31, 1740-4(1957). 13p.

The corrosion of Cu–Ni alloys and Cu and Ni by 10% H_2SO_4 at ambient temperatures was studied. The compositions used were (in at. % Cu): 80, 75, 65, 55, 50, 45, 35, and 25. The results are given as weight loss in g/m^2hr. The rate of attack varied only slightly with alloy composition, indicating the absence of a limit of corrosion resistance. The compositions of the solutions after attack corresponded to the ratio of the components in the alloys. The corrosion limit seems to depend on internal passivity or film formation. (T.R.H.)

18953 CEA-tr-R-661

PHÉNOMÈNES ACCOMPAGNANT LE DÉPÔT ÉLECTROLYTIQUE DU BÉRYLLIUM À PARTIR DES SELS FONDUS. (Phenomena Accompanying the Electrolytic Deposition of Beryllium from Fused Salts.) M. V. Smirnov and L. E. Ivanovskii (Ivanovsky). Translated into French by B. Vinogradoff from Zhur. Fiz. Khim. 32, 2174-82(1958). 18p.

An investigation was made of the polarization of a Mo cathode in molten eutectics of LiCl and KCl containing 0.1, 1.9, and 7.25 wt. % $BeCl_2$ or 3.9 wt. % K_2BeF_4. The studies were made at 400, 500, and 600°C and at current densities ranging from 10^{-3} to 4 amp/cm^2. Reduction of Li^+, Li_2^+, K^+, and K_2^+ took place at the cathode. The cathode potential varies according to the law of concentration polarization. The potential for Be precipitation is 1.2 to 1.4 v. more positive than for the alkali metals. The true current density during metallic deposition increases less rapidly than the electrolytic current and as a consequence the diffusion currents never reach the limits for the discharge of Be^{2+} ions at the nominally high current densities with respect to the geometric surface of the Mo cathode. Addition of fluoride equivalent to K_2BeF_4 considerably increases the Be deposition potential, and lowers the diffusion current limit for discharge of Be^{2+} ions, but has only slight effect on the discharge of alkali metal ions for low current densities and on their separation potential at high current densities. (T.R.H.)

18954 CEA-tr-X-138

SÉPARATION DU CÉSIUM EN QUANTITÉ FAIBLE PAR CHROMATOGRAPHIE ET PAR ÉCHANGE D'IONS. (Separation of Cesium in Low Quantities by Chromatography and Ion Exchange.) N. Yamagata. Translated into French by E. Hera from Nippon Kagaku Zasshi 78, 513-17(1957). 9p.

As a preliminary study of the quantitative analysis of cesium in sea water, potassium chloride containing no cesium was prepared by removal of the cesium by chromatography and ion exchange. The equilibrium constant of cesium in a solution of potassium was measured by utilization of Cs^{137} with carrier. Sodium, potassium, and cesium in sea water can be separated on ion exchange resins. The conditions are described. (tr-auth)

18955 CTS-589

COMPOSITION AND PROPERTIES OF BORIDES OF ELEMENTS OF THE FIRST AND SECOND GROUPS OF THE PERIODIC SYSTEM. (O Sostave i Svoistvakh Boridov Elementov Pervoi i Vtoroi Grupp Periodicheskoi Sistemy.) L. Ya. Markevskii and Yu. D. Kondrashev. Translated for Dept. of Scientific and Industrial Research, London from Zhur. Neorg. Khim. 2, 34-41(1957). 19p. Price £4s. (United Kingdom) £4.16s. (Overseas) DSIR.

Borides of elements of the first two groups of the periodic system are among the most neglected compounds of boron. Some of the data in the literature on the structures and chemical properties of the borides of Groups I and II are evaluated. Previously unpublished work is also considered. (W.D.M.)

18956 NP-tr-254

LIQUID ANION EXCHANGERS. U. Schindewolf. Translated by R. C. Murray (U.K.A.E.A. Atomic Energy Research Establishment) from Z. Elektrochem. 62, 335-40 (1958). 15p. $3.30(ph), $2.40(mf) JCL.

The adsorption of metals by anion exchangers from solutions containing complex anions is discussed. It is also shown that liquid anion exchangers have the same adsorption properties as solid ones. Thus the exchange properties, determined by the active groups or fixed ions of the exchanger phase, do not depend on the physical state of the exchanger. The adsorption behavior agreement of the liquid anion exchangers which were investigated is emphasized. (J.R.D.)

18957 NP-tr-262

CONCERNING THE DEPENDENCE OF THE PHYSICO-CHEMICAL PROPERTIES OF SYNTHETIC OILS ON THE STRUCTURE OF ORIGINAL HYDROCARBONS. (O Zavisimosti Fiziko-Khimicheskikh Svoystv Sinteticheskikh Masel ot Stroeniya Iskhodnykh Uglevodorodov.) M. G. Rudenko and V. N. Gromova. Translated for Wright-Patterson Air Force Base, Ohio, from Khim. i Tekhnol. Topliva, No. 4, 13-19(1956). 19p.

A systematic study was made of the polymerization of individual alkenes, and a comparison was made of the chemical character of the original raw material with the physico-chemical properties of the resulting oils. Data are included from studies on transformations, in the presence of aluminum chloride, of a series of individual alkenes of differing structures. Data are included on: the polymerization of alkenes of normal structure and of those characterized by structural isomerism; of non-displaced cyclenes and cyclenes with side chains; of aromatic hydrocarbons with unlimited side chains; of fractions of cracking benzine of paraffin-like raw materials; of fractions of synthol; and of mixtures of synthol with aromatic hydrocarbons. 50 references. (C.H.)

18958

THE CONCENTRATION OF RADON AND RADIUM METAL IN SPRINGS AND THEIR MINERAL DEPOSITS IN THE BORSEK AND TOPLITSA (TRANSYLVANIA) HEALTH RESORTS. R. Szabo. Acad. rep. populare Romîne, Bul. ştiinţ., Sect. ştiinţe mat. fiz. 9, 537-44 (1957). Translated from Referat. Zhur. Khim. No. 21, 1958, Abstract No. 70454.)

The results of concentration and determination of Rn and Ra metal in 15 springs of Borsek and Toplitsa health resorts are given.

18959

FORCE CONSTANT FOR HEXAFLUORIDES XF_6. Salvatore Califano (Università, Naples). Atti. acad. nazl. Lincei. Rend., Classe sci. fis., mat. e nat. 25, 284-91(1958) Nov. (In Italian)

Recent spectroscopic studies showed that XF_6 hexafluorides (where x = S, Se, Te, Mo, W, U, Re, Ir, Np, or Pu) are in a group with O_N symmetry and have a regular octahedron structure. Previous attempts to calculate the force constants using the simple valency force field or the orbital valency force field have been in error. A new series of calculations for the ten compounds listed above is offered which uses two types of potentials: A quadratic potential made up of four interaction constants and a potential of the Bradley-Urey type. The force constants calculated in the first case exactly represent the experimental frequency, the calculations in the second case represent the experimental frequency with good approximation for only five of the molecules. (T.R.H.)

18960

SPECTROPHOTOMETRIC DETERMINATION OF BORON IN REACTOR MATERIALS. I. DETERMINATION OF BORON IN URANYL NITRATE AND HYDROGEN PEROXIDE SOLUTIONS. T. Nowicka-Jankowska and H. Szyszko. Chem. Anal. (Warsaw) 1, 285-93(1956). (Translated from Referat. Zhur. Khim. No. 8, Abstract No. 24816.)

The B solutions being analyzed are first made alkaline with a solution of NaOH and then evaporated to dryness. They are then used for photometric determinations of B by the carmine method. Optical density is measured at 620 mμ, using a new calibration graph for each series of determinations. For a determination of B in uranyl nitrate the B is separated by distillation, as methyl ester of boric acid, in a quartz apparatus, collecting the methyl borate in an alkali solution. Error of determination of 0.1 to 0.5, γ amounts to ±10%. (auth)

18961

PHOTOCOLORIMETRIC DETERMINATION OF ZIRCONIUM BY MEANS OF MORIN. Hanus Tuma and Narcis Tietz. Chem. listy 51, 722-5(1957). (Translated from Referat. Zhur. Khim. No. 8, 1958, Abstract No. 24782.)

In an acid medium Zr^{4+} forms with morin (I) a soluble lake of lemon-yellow color which is suitable for photometric determination of Zr. Intensity of coloration of the lake in 0.4 to 0.7 N HCl does not depend on concentration of H^+, but at high temperature and prolonged standing it increases and reaches a maximum after 1 hour. With 0 to 0.5 mg Zr per 100 ml solution the law of Beer holds. Morin is prepared as a 0.2% solution in CH_3OH; 1 ml of this solution is used. (auth)

18962

NEW POSSIBILITIES OF SEPARATION AND DETERMINATION OF RHENIUM. Vesceslav Patrovsky Chem. listy 51, 1295-9(1957). (Translated from Referat. Zhur. Khim. No. 10, 1958, Abstract No. 32183.)

The photometrical rhodanide method of Re^{7} determination (Hoffman, J. H., Lundell, G. E. F., Research Natl. Bur. Standards, 1937, 18, 629; 1939, 22, 465; 23, 497) was studied and modified. In contrast to the solutions of complexes of U, Bi, Nb and others with SCN^-, the optical density of the solution of the colored Re complex with SCN^- (0.2 mg of Re). (auth)

18963

VARIATIONS OF THE LUMINESCENCE OF LEAD-ACTIVATED CADMIUM IODIDE WITH THE CONCENTRATION AND TEMPERATURE. Gabriel Monod-Herzen, Nguyen Chung-Tu, and Henri Mulot. Compt. rend. 249, 398-400(1959) July 20. (In French)

The variations in the luminescence of lead-activated cadmium iodide crystals with temperature and lead iodide concentration were measured. The variation with concentration is graphed. The light variation as a function of concentration is shown for temperatures between 25 and 65°C. The graphs have the same aspect for all the temperatures: a straight line portion followed by a curve slightly convex toward higher values of luminescent intensity. The passage between the two regions is found at a concentration of approximately 10^{-3}. It was verified that this convexity indicates the approach of a concentration optimum. The curve representing the maximum of the spectra as a function of activator concentration has, between two abrupt portions, a large plateau extending between concentrations of $10^{-0.5}$ and 10^{-2}. All the spectral curves have a secondary maximum at the longer wave lengths whose maximum increases with decreasing temperature. (J.S.R.)

18964

THE DETERMINATION OF HEAVY WATER IN THE PRESENCE OF ORDINARY WATER. Forsht. Czechoslov. J. Phys. 7, 740-4(1957). (Translated from Referat. Zhur. Khim. No. 21, 1958, Abstract No. 69983.)

The determination was carried out by means of a Zeiss interferometer in a concentration range of 2 to 50% D_2O. When long cuvettes are employed, low concentrations may be determined with an accuracy sufficient for control analysis in D_2O production.

18965

THE RELATION BETWEEN KINETIC ISOTOPIC EFFECTS ON $C^{12}-C^{14}$ AND $C^{14}-C^{14}$ BOND RUPTURE. A. M. Brodskii, R. A. Kalinenko, and K. P. Lavrovskii (Inst. of Chemical Synthesis of Petroleum, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 1293-5(1959) June 21. (In Russian)

The kinetic isotopic effect in the $C^{12}H_3-C^{12}H_3$ ethane and double labeled C^{14} ethane $C^{14}H_3-C^{14}H_3$ mixture during bond rupture at high temperature was studied and compared to the effect in $C^{14}H_3-C^{12}H_3$. The experiments were carried out at 850°C under 94 ± 2 mm pressure in a reactor with practically complete mixing. The activity of the original $C^{12}H_3-C^{12}H_3$ and $C^{14}H_3-C^{14}H_3$ mixtures was $A = 1.1 \times 10^4$ pul/min. cm. The data on methane and ethylene activity showed that the kinetic isotopic effect for methane formed from $C^{14}H_3-C^{14}H_3$ is 5 ± 1%, which is considerably lower than the 12 ± 2% previously reported for $C^{14}H_3-C^{12}H_3$. The results indicate the absence of a direct relation between kinetic isotopic effects and the given mass and confirm the previous postulation on the effects of molecular symmetry disturbance on the rate of reaction. (R.V.J.)

18966

THE LUMINESCENCE SPECTRUM OF ADSORBED URANYL IONS AS AFFECTED BY THE SURFACE OF THE ADSORBENT. G. I. Kobyshev (Zhdanov Leningrad State Univ.). Doklady Akad. Nauk S.S.S.R. 127, 373-6 (1959) June 11. (In Russian)

The changes in uranyl ion luminescence spectra when adsorbed on an oxide surface were studied to determine the nature of luminescence spectrum sensitivity to surrounding media. An attempt was made to use the coördinate ion luminescence spectrum with well defined spectral vibration structure for correlation with the changes taking place in adsorption. The luminescence lines for $UO_2 \cdot 2H_2O^{2+}$ adsorbed on silica gel, microporous glass, alumogel, alumosilicagel, magnesium oxide, and chromatographic paper at 90°K are plotted. (R.V.J.)

18967

ISOTOPE EFFECTS IN THE ENZYMATIC DECARBOXYLATION OF OXALACETIC ACID. Stanley Seltzer, Gordon A. Hamilton, and F. H. Westheimer (Harvard Univ., Cambridge, Mass.). J. Am. Chem. Soc. 81, 4018-24(1959) Aug. 5.

$HO_2C-CO-CH_2-C^{13}O_2H$ has been prepared and decarboxylated in the presence of metal ions and in the presence of the partially purified enzyme from Micrococcus lysodeikticus. The reaction catalyzed by Mn^{++} at 10° showed an isotope effect, k^{12}/k^{13}, of nearly 1.06, whereas the ratio for the enzymatic reaction was 1.00. Further, the enzymatic decarboxylation proceeds less rapidly in D_2O than in H_2O, whereas the rate for the metal ion-promoted reaction is unaffected by this change in solvent. These facts show that the carbon–carbon bond scission is the rate-controlling process for the non-enzymatic reaction but not for that promoted by the enzyme. The actual rates make it probable that the carbon–carbon bond cleavage for the enzymatic reaction exceeds that for the non-enzymatic reaction by a factor of the order of 10^8. (auth)

18968

ON THE EFFECT OF DOSE RATE ON THE RADIOLYSIS OF LIQUID HYDROCARBONS. Robert H. Schuler (Mellon Inst., Pittsburgh) and G. A. Muccini (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 81, 4115-16(1959) Aug. 5.

Preliminary experiments were undertaken to examine the dose rate dependence of the secondary reactions in the cyclopentane–cyclohexane system. (J.E.D.)

18969

THE FIRST ISOLATIONS OF THE TRANSURANIUM ELEMENTS–A HISTORICAL SURVEY. J. C. Wallmann (Univ. of California, Berkeley). J. Chem. Educ. 36, 340-3(1959) July.

The history of the isolation which included purification of the element from contaminants and measurement of the property of the element is given for plutonium, neptunium, americium, curium, berkelium, and californium. (C.J.G.)

18970

THE RATES OF THE ELECTRON EXCHANGE REACTION BETWEEN U(IV) AND U(VI) IONS IN WATER, ETHANOL AND WATER–ETHANOL SOLVENTS. Daniel M. Mathews, Jack D. Hefley, and Edward S. Amis (Univ. of Arkansas, Fayetteville). J. Phys. Chem. 63, 1236-40(1959) Aug.

The rate of the electron exchange reaction between U(IV) and U(VI) ions was studied at 25° in water, ethanol and water–ethanol solvents and at various concentrations of U(IV), U(VI), and hydrochloric acid. The order of the reaction with respect to each of these substances was found to depend strongly on the composition of the solvent. Mechanistic and kinetic expressions are suggested which can account for these orders in solvents up to 60 vol.% ethanol. (auth)

18971

THE THERMODYNAMICS OF DILUTE SOLUTIONS OF $AgNO_3$ AND KCl IN MOLTEN KNO_3, FROM ELECTROMOTIVE FORCE MEASUREMENTS. I. EXPERIMENTAL. Milton Blander, F. F. Blankenship, and R. F. Newton (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 1259-61(1959) Aug.

Measurements of the activities of $AgNO_3$ were made in a fused salt concentration cell at 370 and 436° in dilute solutions of Ag^+ and Cl^- ions. The activities of $AgNO_3$ obeyed the Nernst law at the low concentrations of $AgNO_3$ measured when no Cl^- ions were present. The dissolution of KCl in a $AgNO_3-KNO_3$ mixture lowered the activity of $AgNO_3$. The lowering was larger the larger the amount of KCl added and for a given concentration of KCl was also larger the smaller the initial concentration of $AgNO_3$. This shows that the Nernst law is not obeyed for $AgNO_3$ in the presence of Cl^- ion. (auth)

18972

THE THERMODYNAMICS OF DILUTE SOLUTIONS OF $AgNO_3$ AND KCl IN MOLTEN KNO_3 FROM ELECTROMOTIVE FORCE MEASUREMENTS. II. A QUASI-LATTICE MODEL. Milton Blander (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 1262-5(1959) Aug.

A new theory based on a quasi-lattice model of the molten reciprocal salt system A^+, B^+, C^- and D^- dilute in A^+ ions in which the A^+ and C^- ions have an extra-coulombic interaction yields the result for the activity coefficient of the component

AD: $\gamma_{AD} = \left[(1-X)^Z\left(1+\frac{X}{\beta(1-X)}\right)^{Z-1}\right]N_{D^-}$, where Z is the quasi-lattice coördination number, $\beta = e^{-\Delta E/RT}$, ΔE is the energy of formation of a mole of the ion pairs A^+-C^- and X, which can be calculated from the theory,

is the fraction of positions adjacent to an A^+ ion occupied by C^- ions. $(1-X)^Z$ is the fraction of A^+ ions that have no C^- ions adjacent to them. In the "complex" ion terminology these are "free" or "uncomplexed" A^+ ions and $(1-X)^Z$ alone, in that terminology, should be equal to γ_{AD}. The other terms are significant for low values of β and high values of N_{C^-}. A comparison of the theory and measurements of the Ag^+, K^+, Cl^-, NO_3^- system at 370 and 436° indicates that the theory is valid at low values of X (< 0.15) and of N_{Ag^+} ($\leq 0.720 \times 10^{-3}$). A value of $\Delta E = -5.6_6$ kcal./mole and -5.6_4 kcal./mole for the energy of formation of the ion pair Ag^+-Cl^- is derived from the comparison for Z = 6 at 370 and 436°, respectively. While the value of ΔE is slightly sensitive to the arbitrary choice of Z the value of $Z\beta$ is relatively insensitive to Z. At higher concentrations of Ag^+ ions and higher values of X, the error due to the approximations made in the derivation of the theory becomes significant. (auth)

18973

PHASE EQUILIBRIA IN THE FUSED SALT SYSTEMS $LiF-ThF_4$ AND $NaF-ThF_4$. R. E. Thoma, H. Insley, B. S. Landau, H. A. Friedman, and W. R. Grimes (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 1266-74(1959) Aug.

Detailed phase equilibrium diagrams are presented for the binary systems $LiF-ThF_4$ and $NaF-ThF_4$. Data for the determination of phase boundaries and solid state transitions were obtained from thermal analysis of heating and cooling curves and by quenching after equilibration. Phases were identified with the use of the x-ray diffractometer and the petrographic microscope. Four compounds, $3LiF\cdot ThF_4$, $7LiF\cdot 6ThF_4$, $LiF\cdot 2ThF_4$, and $LiF\cdot 4ThF_4$, have been identified in the system $LiF-ThF_4$. These melt incongruently with the exception of $3LiF\cdot ThF_4$. Five compounds, $4NaF\cdot ThF_4$, $2NaF\cdot ThF_4$, $3NaF\cdot 2ThF_4$, $NaF\cdot ThF_4$, and $NaF\cdot 2ThF_4$ have been identified in the system $NaF-ThF_4$. These melt incongruently with the exception of $2NaF\cdot ThF_4$ and $3NaF\cdot 2ThF_4$ which melt congruently. A metastable solid phase having the composition $7NaF\cdot 6ThF_4$ has been identified. The compounds $4NaF\cdot ThF_4$ and $3NaF\cdot 2ThF_4$ do not exist as equilibrium phases at low temperatures. The compound $4NaF\cdot ThF_4$ decomposes on cooling into NaF and $2NaF\cdot ThF_4$ at 565°; the compound $3NaF\cdot 2ThF_4$ decomposes on cooling into $2NaF\cdot ThF_4$ and $NaF\cdot ThF_4$ at 693°. Optical measurements and x-ray diffraction data have been obtained for each of the solid phases observed in the systems $LiF-ThF_4$ and $NaF-ThF_4$. (auth)

18974

SPECTROSCOPIC STUDIES ON RARE EARTH COMPOUNDS. III. THE INTERACTION BETWEEN NEODYMIUM AND PERCHLORATE IONS. P. Krumholz (Research Lab. of Orquima S.A., São Paulo, Brazil). J. Phys. Chem. 63, 1313-14(1959) Aug.

Absorption spectra of 0.02 M aqueous solutions of neodymium perchlorate were measured at 25°C for solutions containing perchloric acid in concentrations from 0.002 to 11.8 M. Typical results of the band system around 5200 and 5750 A are tabulated. (J.E.D.)

18975

THE HYDROLYSIS OF NEPTUNIUM(IV). J. C. Sullivan and J. C. Hindman (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 63, 1332-3(1959) Aug.

A study was made of the comparative effects of water and deuterium on the hydrolysis of neptunium(IV) and uranium(IV) at 25°C. (J.E.D.)

18976

INFLUENCE OF IMPURITIES ON THE ELECTROLYTIC CONCENTRATION OF HEAVY WATER. J. Brun, W. Gundersen, and Th. Varberg (Technical Univ. of Norway, Oslo). Kgl. Norske Videnskab. Selskabs. Forh. 30, No. 5, 29-34(1957).

Lowering of the separation efficiency of iron cathodes for hydrogen isotopes was observed with additives as zinc and tin causing increase of hydrogen overvoltage at the cathode and additives such as platinum, chromate, and vanadate tending to decrease the overvoltage. The separation factor of a tin coating on iron, overvoltage about 1.00 volt, was almost as low as that of platinized iron cathodes, overvoltage of 0.21 volt. Low separation efficiency of cathodes covered with platinum black with 2.5×10^{-4} and 5×10^{-4} gramatoms Pt per l gave as low separation factors as 3.1 and 3.2, respectively. (C.J.G.)

18977

TITRIMETRIC DETERMINATION OF ZIRCONIUM. Anna Schneer and Hildegard Hartmann. Magyar Kem. Folyóirat 63, 295-6(1957). (Translated from Referat. Zhur. Khim. No. 8, 1958, Abstract No. 34783.)

Description of 2 new methods of determining Zr in minerals are presented. Zr is precipitated from hydrochloric acid solution with mandelic acid (I) or with p-bromomandelic acid (II), the precipitate is dissolved in a saturated solution of Na_2CO_3, I (or II) is oxidized with $KMnO_4$, to benzoic (or p-bromobenzoic) acid and the excess $KMnO_4$ is determined in the usual manner with $H_2C_2O_4$. From 2 to 50 mg Zr are determined with an error of ±1%. The second method is suitable for determination of less than 2 mg Zr. $Na_2Cr_2O_7$ is used as oxidizing agent in concentrated H_2SO_4. Excess of oxidizing agent is determined by titration with a solution of $FeSO_4$ in the presence of ferroin as indicator. 1 to 5 mg Zr are determined with an error from 1 to −2%; less than 1 mg Zr—with an error of −2 to −5%. (auth)

18978

THE ISOTOPIC EFFECT OF DEUTERIUM ON THE EQUILIBRIUM STATE OF WATERGAS REACTION. Piroska Caányi Fodorné. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 359-63(1957) May–June.

The variation of the watergas reaction equilibrium constant was studied in the presence of deuterium oxide. It was shown by two different equilibrium composition measurements that no isotopic effect occurs as the value of the equilibrium constant did not change for the measurements carried out with deuterium oxide of various concentrations. The experimental results do not exclude the possibility of a change in reaction velocities. It is only shown that changes in both directions do not alter the equilibrium constant. (auth)

18979

ANALYSIS FOR MAGNESIUM IN HIGH-PURITY ALUMINIUM. C. A. Youngdahl and F. E. DeBoer (Argonne National Lab., Lemont, Ill.). Nature 184, 54-5(1959) July 4.

The Al stocks analyzed were supplied as 99.99 or 99.999% pure. The apparatus used for the distillation consists of a Vycor bell jar connected to a conventional high vacuum system. The procedure is as follows. A 10 g sample is wet ground, degreased, and etched in

KOH and weighed. It is then held at a temperature just below the melting point in the apparatus until degassing is completed. Afterwards, the temperature is raised to 925 to 1,000°C and held for 10 to 15 min in a vacuum of $\sim 10^{-6}$ mm Hg. After cooling, the distilled metal which was condensed on the bell jar is dissolved in HCl or aqua regia. The solution is analyzed by spectroscopy or other convenient means. (W.L.H.)

18980

VOLATILE METHOXIDES OF ALUMINIUM AND ZIRCONIUM. D. C. Bradley and M. M. Faktor (Birkbeck Coll., London). Nature 184, 55-6(1959) July 4.

Aluminum methoxide was heated at 150°C and $\sim 10^{-6}$ mm Hg and after 24 hours a trace of sublimate had appeared. The temperature was then raised to 240°C and rapid sublimation occurred. A sample of zirconium methoxide was heated in a molecular still at 250°C and slowly sublimed, but at 280°C sublimation was rapid and complete. Lithium, magnesium, and lanthanum methoxides did not show any evidence of sublimation at 360°C during a period of 18 hours in the molecular still but they remained completely stable. (W.L.H.)

18981

RADIOACTIVE WASTE WATER OF ATOMIC REACTOR COOLING; ITS DECONTAMINATION AND DISPOSAL. Ivan Zezula. Pracovní lékarství 9, No. 5, 431-9; No. 6, 538-47(1957). (Translated from Referat. Zhur. Khim. No. 18, 1958, Abstract No. 61394.)

A detailed systematized review is presented. A bibliography with 106 titles is also included. (auth)

18982

A STUDY ON THE FALLING-DROP METHOD OF ANALYSIS OF HEAVY WATER. Tsing-Lien Chang, Chih-hsiang Cheng, and Huei-pi Hsu. Sci. Record (Peking) 1, 417-19(1957). (Translated from Referat. Zhur. Khim. No. 18, 1958, Abstract No. 60100.)

An improved microdropper construction is described. The design of the dropper is such that the drop volume can be reproduced with an accuracy of 0.3%. At the expense of the above, as well as at the expense of the increase of the thermostating accuracy to 0.0005°, the accuracy of measurement of D_2O concentrations below 1% is 0.003 to 0.005 mole % of D_2O. The dependence of the density of o-fluorotoluene on the temperature was determined in the range from 14 to 30°C. (auth)

18983

THORIUM AND THORIUM COMPOUNDS. D. I. Ryabchikov and E. K. Gol'braikh. Uspekhi Khim. 28, 408-35(1959) Apr. (In Russian)

A detailed review is given on thorium and thorium compounds. Preparation, properties, and uses are discussed. 288 references. (R.V.J.)

18984

THE BINARY SYSTEM BORON FLUORIDE-WATER. Stephan Pawlenko. Z. anorg. u. allgem. Chem. 300, 152-8(1959). (In German)

Solidification points and densities of the system BF_3-H_2O have been determined. There is a eutectic point between $BF_3 \cdot H_2O$ ($H[BF_3OH]$) and $BF_3 \cdot 2\,H_2O$ ($H_3O[BF_3OH]$) at 73.7 per cent by weight BF_3 and a temperature of −44°C. The results are discussed and compared with those of former investigations. (auth)

18985

ENTHALPY OF FORMATION OF BERYLLIUM FLUORIDE. V. P. Kolesov, M. M. Popov, and S. M. Skuratov (Lomonosov Moscow State Univ.). Zhur. Neorg. Khim. 4, 1233-6(1959) June. (In Russian)

18986

ENTHALPY OF FORMATION OF LITHIUM OXIDE. V. P. Kolesov, S. M. Skuratov, and I. D. Zaikin (Lomonosov, Moscow State Univ.). Zhur. Neorg. Khim. 4, 1237-40(1959) June. (In Russian)

The enthalpy of lithium oxide-water reactions at 20°C is -31.41 ± 0.08 kcal/mole. The enthalpy of Li_2O formation at 25°C was estimated as -142.8 ± 0.3 kcal/mole. (R.V.J.)

18987

HEAT CAPACITY AND HEAT OF FUSION OF UCl_4 AND UI_4 AND HEAT OF TRANSFORMATION OF UI_4. M. M. Popov, G. I. Gal'chenko, and M. D. Senin. Zhur. Neorg. Khim. 4, 1241-5(1959) June. (In Russian)

18988

ON THE THORIUM TETRAFLUORIDE CRYSTAL HYDRATES. Yu. V. Gagarinskii and V. P. Mashirev. Zhur. Neorg. Khim. 4, 1246-52(1959) June. (In Russian)

The phase structures formed by dehydration, the heat of hydration of the phases, and the composition of thorium tetrafluoride crystal hydrates were investigated. It was found that in dehydration of $ThF_4 \cdot 2.5H_2O$ and $ThF_4 \cdot 0.5H_2O$ in vacuum with slow temperature increase up to 250°C, the forming phase retains the original crystal hydrate structure. The heat of hydration of anhydrous phases, formed by dehydration of $ThF_4 \cdot 2.5H_2O$ and $ThF_4 \cdot 5H_2O$ at 25° was 2073 ± 4 and 1174 ± 5 cal/mole, respectively. (R.V.J.)

18989

ON THE URANIUM TETRAFLUORIDE CRYSTAL HYDRATES. Yu. V. Gagarinskiĭ and V. P. Mashirev. Zhur. Neorg. Khim. 4, 1253-9(1959) June. (In Russian)

Calorimetric, tensimetric, and x-ray studies of UF_4 crystal hydrates are described. It is shown that hydrous UF_4 prepared by dehydration of lower crystal hydrates in vacuum with slowly rising temperature up to 225°C retains the original structure. The heat of hydration is 6.09 ± 0.01 kcal/mole. The composition of the pseudocubic structure is $UF_4 \cdot 0.4H_2O$. Tensimetric data indicate that a solid aqueous solution forms during the dehydration of the higher crystal hydrate $UF_4 \cdot 2.5H_2O$. (tr-auth)

18990

ON THE POLYMORPHISM AND THERMAL TRANSFORMATION PROCESSES OF ALUMINUM OXIDE. A. M. Kalinina (Chemical Inst. of Silicates, Academy of Sciences, U.S.S.R.). Zhur. Neorg. Khim. 4, 1260-9(1959) June. (In Russian)

Systematic investigations were made of transitions in aluminum oxide hydrates and aluminum crystalline salts at 200 to 1300°C. (R.V.J.)

18991

ON THE DEGREE OF POLYMERIZATION OF SOME PERURANIUM ANIONS IN SOLUTIONS. A. M. Gurevich and E. V. Komarov. Zhur. Neorg. Khim. 4, 1309-12 (1959) June. (In Russian)

The cryoscopic behavior of peruranite containing two peroxide groups per atom of uranium was investigated by using eutectics of $NaNO_3$ ice. The dissociation process of $Na_4UO_8 \cdot 9H_2O$ in aqueous solution proceeds along the following scheme: $Na_4UO_8 \rightleftharpoons UO_8^{4-} + 4Na^+$; thus the anion UO_8^{4-} is a monomer. The reaction of

the first step in anion hydrolysis in dilute solutions of $UO_3^{2-} + H_2O \rightleftharpoons HUO_3^{3-} + OH^-$ is not followed by polymerization. It is shown that the interactions of $Na_4UO_5 \cdot 9H_2O$ with HNO follows the reaction: $2Na_4UO_5 + 4HNO_3 \rightarrow Na_4H_4U_2O_{13} + 4NaNO_3 + 2H_2O_2$. (R.V.J.)

18992

DISPROPORTIONATION OF Pu(IV) AND Pu(V) IN NITRIC ACID SOLUTIONS. P. I. Artyukhin, V. I. Medvedovskii, and A. D. Gel'man (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Neorg. Khim. 4, 1324-31(1959) June. (In Russian)

The analysis of disproportionation of Pu(IV) and Pu(V) in nitric acid solutions at different concentrations showed that disproportionation of Pu(IV) follows an identical mechanism to that in perchloric acid. Because of complex formation, the equilibrium constant for the reaction $3Pu(IV) \rightleftharpoons 2Pu(III) + Pu(VI)$ is an inverse ratio to nitric acid concentration at 5.3°C. The rate of disproportionation of Pu(V) in nitric acid solutions increases with hydrogen ion concentration. It is also shown that at the beginning the disproportionation of Pu(V) is determined by the reaction $Pu(V) + Pu(V) \rightleftharpoons Pu(IV) + (Pu(VI)$, but with the accumulation of Pu(III), the reaction $Pu(V) + Pu(III) \rightleftharpoons 2\ Pu(IV)$ begins to prevail, leading to the autocatalytic acceleration of the process. (R.V.J.)

18993

STUDIES OF COMPLEX FORMATION OF PENTAVALENT PLUTONIUM IN ETHYLENEDIAMINETETRAACETATE SOLUTIONS BY AN ION EXCHANGE METHOD. A. D. Gel'man, P. I. Artyukhin, and A. I. Moskvin (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Neorg. Khim. 4, 1332-5 (1959) June. (In Russian)

Studies of PuO_2^+ complex formation in ethylene diaminetetraacetate solutions showed that a complex ion PuO_2Y^{3-}, with dissociation constant 6.8×10^{-11}, forms in the pH 4 to 5 region. A relative tendency of plutonium to complex formation with Y^{4-} ion was investigated, and it is shown that the tendency is in direct relation to the ion potential of plutonium in various valencies. (R.V.J.)

18994

ON THE RELATIVE STABILITY OF ALUMINUM, TITANIUM, VANADIUM, IRON, AND COPPER TARTRATE COMPLEXES IN ALKALI MEDIA. I. V. Pyatnitskii and A. P. Kostyshina. Zhur. Neorg. Khim. 4, 1341-6(1959) June. (In Russian)

The stability of aluminum, copper, iron, titanium, and vanadium tartrate complexes was determined using bond magnitudes as criteria (the ratio between the concentrations of complexed and free ions at a certain standard acid condition). A method is suggested for determining the ratio of the bonds combining the complexes of two metals. The partition constants of aluminum, copper, iron(III), and vanadium hydroxyquinolinates between the aqueous solution and chloroform were 2.6×10^{-33}, 7.3×10^{-23}, 1.5×10^{-37}, and 4.2×10^{-23}, respectively. The relative stability of copper and iron tartrate complexes in alkali solution (pH 13) and aluminum, iron(III), titanium, and vanadium(IV) tartrate complexes in ammonium solution (pH 9.5) was determined. (R.V.J.)

18995

ON THE SCANDIUM FERROCYANIDES. G. B. Seifer and E. A. Ionova. Zhur. Neorg. Khim. 4, 1362-8(1959) June. (In Russian)

Investigations were made of scandium chloride interactions with cesium, lithium, potassium, rubidium, and sodium ferrocyanides. A systematic physicochemical analysis was made of the rare-earth ferrocyanides starting with lanthanum through yttrium and cesium. (R.V.J.)

18996

LANTHANUM SALICYLATE COMPLEXES. Ya. A. Fialkov and V. I. Ermolenko (Inst. of Generae and Inorganic Chemistry, Academy of Sciences, Ukrainian S.S.R.). Zhur. Neorg. Khim. 4, 1369-76(1959) June. (In Russian)

It was found that lanthanum salicylate is soluble in alkali solution of sodium salicylate (0.5 to 4 mole/l) with added caustic soda up to 10 to 13 pH. Potentiometric titration of lanthanum salicylate (1 mole) with caustic soda in 2 to 4 M sodium salicylate solution showed that lanthanum titrates as a weak dibasic acid. The acid dissociation constants are given. Formation of complex lanthanum salicylates and their instability constants were established on the basis of studies of $La(OH)_3-NaSal-NaOH-H_2O$. (R.V.J.)

18997

ON THE CERIUM SALT COMPOUNDS WITH PYRIDINE AND QUINOLINE. V. V. Serebrennikov, E. I. Ivanova, and L. A. Alekseenko. Zhur. Neorg. Khim. 4, 1377-81 (1959) June. (In Russian)

Problems arising in trichloride and cerium sulfate interactions with pyridine and quinoline and the effects of temperature on the stability of compounds $CeCl_3 \cdot nPy[CePy_6][Cr(CNS)_6]$ and $[CeChin_6][Cr(CNS)_6]$, as well as their pyridine and quinoline yield in storage over sulfuric acid, are analyzed. (R.V.J.)

18998

ON THE LOSSES OF CRYSTALLIZATION WATER BY THE SULFATES OF THE CERIUM GROUP RARE EARTHS. L. A. Alekseenko, A. F. Lemenkova, and V. V. Serebrennikov. Zhur. Neorg. Khim. 4, 1382-5 (1959) June. (In Russian)

Thermographic and thermogravimetric studies were made of the sulfate octahydrates of cerium, lanthanum, neodymium, praseodymium, and samarium at 20 to 270°C. (R.V.J.)

18999

HEAT TRANSFORMATION OF HYDROXY COMPOUNDS OF GALLIUM, INDIUM AND SCANDIUM. B. N. Ivanov-Emin and L. A. Nisel'son (Kalinin, Moscow Inst. of Non-Ferrous Metals and Gold). Zhur. Neorg. Khim. 4, 1386-92(1959) June. (In Russian)

The thermal stability of hydroxy compounds of elements of the third periodic group, with different ionic potentials, was investigated. The hydroxygallates of lithium, potassium, and sodium, the hydroxyindates of potassium and sodium, and the hydroxyscandate of sodium were studied by combining thermoanalysis with dehydration and by correlation of Debyegrams of the original materials with the products of the transformations. (R.V.J.)

19000

IODIDE SOLUBILITY IN IODIDE SOLUTIONS OF RARE-EARTH ELEMENTS. V. V. Serebrennikov and N. P. Votinova. Zhur. Neorg. Khim. 4, 1428-30(1959) June. (In Russian)

Data are presented on iodide solubility in iodide solutions of lanthanum and cerium. The data are correlated with data on neodymium, praseodymium, and

samarium. It is shown that iodide solubility increases with the increase of lanthanum and cerium iodide concentrations due to the appearance of polyiodides. (R.V.J.)

19001

THE DEVELOPMENT OF NUCLEAR RADIATION RESISTANT FLUIDS AND LUBRICANTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-113. W. L. R. Rice and D. A. Kirk (Wright Air Development Center, Dayton, Ohio). 26p. $0.50.

This report presents a summary of the state of the art of high temperature, nuclear radiation resistant fluid and lubricant development. Data are presented on the effects of gamma radiation on selected materials, showing the limitations of each. Suitability of greases and solid film lubricants for use in a radiation environment is considered. The development of new fluids for multifunctional applications in extremes of temperature and nuclear radiation is outlined. Particular emphasis is placed on the polyphenyl ethers, with a presentation of data to show their superior stability to thermal and nuclear radiation. (auth)

19002

SOME APPLICATIONS OF MOLECULAR BEAM TECHNIQUES TO CHEMISTRY. Sheldon Datz and Ellison H. Taylor (Oak Ridge National Lab., Tenn.). p.157-80 in "Recent Research in Molecular Beams." New York, Academic Press, Inc.

Molecular beam techniques applied by several scientists in studies of the interaction of gas molecules with solid surfaces, surface ionization, and gas-gas interactions are discussed. (C.J.G.)

19003

SEMICONDUCTORS. N. B. Hannay, ed. New York, Reinhold Publishing Corporation, 1959. 788p.

This book was written with a desire to satisfy the requirements of two kinds of readers. The first group includes chemists, either graduate students or chemists whose major interests lie outside the particular subject of this book, who may have a desire to learn something about a field which is rapidly absorbing the attention of more and more chemists. Secondly, there are the chemists, physicists, and metallurgists who are actively working in the field, who may find illuminating a treatment of semiconductors which emphasizes the chemical aspects of the subject. General background on the physics and chemistry of semiconductors, physical chemistry, relationship between chemistry and electrical and optical properties, and surface properties of semiconductors are treated. (W.D.M.)

Radiation and Radiochemistry

19004 AERE-C/R-1569

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DECOMPOSITION OF AMMONIA AND CARBON TETRAFLUORIDE BY PILE IRRADIATION. P. C. Davidge. Dec. 21, 1955. 19p.

Sealed tubes containing ammonia and carbon tetrafluoride have been irradiated in BEPO. The ammonia sample irradiated for the longest period, 52 days, had been 20% decomposed. The initial rate of ammonia decomposition corresponded to a G value of 3.5 molecules decomposed per 100 ev absorbed. The carbon tetrafluoride samples were irradiated for 30 days; over this period approximately 1.4 parts by volume of fluorine were formed per 100 volumes of CF_4 originally present. This rate of fluorine production corresponded to an average G value of 0.28 molecules of fluorine per 100 ev of energy absorbed. (auth)

19005 AERE-M-452

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

EXCHANGE OF COBALT 60 WITH BASIC COBALT HALIDES. N. Turton. June 1959. 13p. $0.35(BIS).

A process is described for obtaining very high specific activity Co after comparatively short pile irradiations. A series of basic cobalt halides was prepared and their exchange properties studied as a means of checking their structures. (W.D.M.)

19006 AERE-M/M-85

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England and Birmingham. Univ., England.

THE MECHANISMS OF RADIATION-INDUCED CHANGES IN HIGH POLYMERS. A. Charlesby and J. C. Bevington. Nov. 10, 1954. 6p.

A comparison is made between the behavior of long-chain polymers when exposed to high-energy radiation. The termination mechanism is ordinary chemical polymerization. An attempt is made to explain the different behavior of polystyrene and polymethyl methacrylate in terms of the rate of the combination and disproportion mechanisms. (auth)

19007 IG-R-149(O/W)

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

ANALYTICAL METHOD FOR THE DETERMINATION OF STRONTIUM 89 AND STRONTIUM 90 IN SOIL AND MAT SAMPLES. Apr. 29, 1959. 14p.

Radio-strontium, together with added strontium carrier, is chemically separated, and the β activity is measured. After allowing the daughter element yttrium-90 to grow nearly to equilibrium, radio-yttrium, together with added yttrium carrier, is chemically separated, and the β activity is measured. The counting equipment is calibrated against sources of known strontium-89 and strontium-90 activities. (auth)

19008 IGO-AM/S-193

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF THORIUM IN THORITE ORES. May 1, 1959. 14p. $0.35(BIS).

The ground sample is leached by refluxing with nitric acid. The resulting solution is filtered, and the soluble portions are treated separately. The soluble thorium is purified by passage through a cellulose-alumina column, precipitated first as hydroxide, then as oxalate, and finally weighed as the dioxide. The insoluble thorium is brought into solution by a fluoride-hydrogen sulfate fusion, purified by extraction with TBP-xylene, and finally determined absorptiometrically as its thorin complex. The method is applicable to Nigerian thorite with thorium concentration 5-10% Th. (auth)

19009 KAPL-M-DGM-2

Knolls Atomic Power Lab., Schenectady, N. Y.

THE NONDESTRUCTIVE DETERMINATION OF UO_2 DISTRIBUTION IN UO_2-Zr DISPERSION TYPE FUEL

PLATES. D. G. Miller. Jan. 29, 1959. 17p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Experimental work in the development of a method for the nondestructive determination of the distribution of U in UO_2–Zircaloy-2 dispersion type fuel plates is summarized. The horizontal homogeneity of UO_2–Zircaloy-2 dispersion type fuel plates can be determined with a precision of better than ± 5% at 90% confidence level using one minute counts over ¼-in. increments of fuel length. Total fuel load in the defined compacts can be determined to a precision of at least ± 1% at 90% confidence level using one minute counts over fourteen ¼-in. increments of fuel length. The method is applicable to any plate with fuel loads in the range 0.2 to 1.0 g. U^{235} per in. and with fuel thickness below 0.2 in. (W.L.H.)

19010 SCS-M-142

United Kingdom Atomic Energy Authority Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF ZIRCONIUM IN URANIUM METAL AND URANIUM TETRAFLUORIDE. July 14, 1954. 6p.

The metal is dissolved in a mixture of nitric acid and hydrofluoric acid and the tetrafluoride in a mixture of nitric acid and perchloric acid. The solution obtained is evaporated down to fumes of perchloric acid. Zirconium is precipitated with mandelic acid, the precipitate dissolved in sulfuric acid, E.D.T.A. added in excess, and this excess titrated with standard iron solution. This method is suitable for the determination of 2.5 to 100 mg of zirconium with an over-all accuracy of ± 1%. (auth)

19011 AEC-tr-3714

PREPARATION OF ARTIFICIAL RADIOISOTOPES OF HIGH SPECIFIC ACTIVITY. R. Henry. Translated by A. L. Monks (Oak Ridge National Lab.) from a lecture given at The Atom Fair, Cleveland, Ohio, March 17, 1959. 10p. $1.80(ph), $1.80(mf) JCL.

In the preparation of artificial radioelements, research on the specific activities is absolutely necessary for certain applications. Three methods for preparing high specific activity isotopes are discussed. The methods are; use of nuclear reactions causing a change in the atomic number, irradiation of stable enriched isotopes, and utilization of the Szilard-Chalmers effect. (W.D.M.)

19012 CEA-tr-A-322

MESURE DIRECTE DES SUBSTANCES RADIOACTIVES CONTENUES DANS LES LIQUIDES. (Direct Measurement of Radioactive Substances Contained in Liquids.) K. Jordan. Translated into French from Atompraxis 3, 398-402(1957). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3556.

19013 CEA-tr-A-396

L'ENRICHISSEMENT ISOTOPIQUE LORS D'UNE EVAPORATION LENTE DE L'EAU. (Isotopic Enrichment During Slow Evaporation of Water.) Translated into French from "J. Stefan" Inst. Rpts. (Ljubljana) 3, 149-56(1956). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 12128.

19014 CEA-tr-A-588

MÉTHODE SIMPLIFIÉE DE DOSAGE DES COMPOSÉS RENFERMANT DU ^{14}C. (Simplified Methods of the Determination of Compounds Containing C^{14}.) H. Gotte, R. Kretz, and Hildegard Baddenhausen. Translated into French from Angew. Chem. 69, 561-2(1957). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5242.

19015 CEA-tr-R-303

CONFÉRENCE SUR L'EMPLOI DES TRACEURS ISOTOPIQUES DANS LA CHIMIE DES COMPLEXES. (Conference on the Use of Isotopic Tracers in the Chemistry of Complexes.) N. K. Davidenko (Davydenko). Translated into French by B. Vinogradoff from Zhur. Fiz. Khim. 30, 2127-9(1956). 10p.

Brief descriptions are given of the papers presented at a conference on the use of isotopic tracers in the chemistry of complexes held at Kiev in October, 1955. (T.R.H.)

19016 IGRL-T/CA-103

THE ENRICHMENT OF URANIUM ISOTOPES IN THE GAS CENTRIFUGE. W. Groth. Translated by B. Rigby (U.K.A.E.A., Risley) from Nukleonik 1, 68-73(1958). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as Abstract No. 13307.

19017 IGRL-T/CA-111

SPECTRAL ANALYSIS OF ISOTOPIC COMPOSITIONS OF HYDROGEN-DEUTERIUM MIXTURES. G. V. Weinberg, A. N. Zaidel, and A. A. Petrov. Translated by L. H. Sinclair (U.K.A.E.A., Risley) from Optika i Spektroskopiya 1, 972-82(1956). 15p.

The effect of various factors on the intensity ratio of components of the isotopic structures of the first members in the Balmer series has been investigated. It has been shown that the principal factor influencing this ratio is the separation of the hydrogen isotopes. Conditions were determined such that the intensity ratio of the components is equal to the concentration ratio of the isotopes, thus enabling isotopic analysis in the concentration range 10 to 90% H_2 to be carried out without the necessity of constructing calibration graphs. (auth)

19018

QUANTITATIVE DETERMINATION OF IODINE AND IODINE COMPOUNDS ON CHROMATOGRAPHIC PAPER BY NEUTRON ACTIVATION. H.-J. Born and H. Stärk (Technische Hochschule, München). Atomkernenergie 4, 286-9(1959) July-Aug. (In German)

By short-time activation with thermal neutrons, up to 0.02 μg of iodine and iodine compounds can be determined quantitatively on chromatographic paper. The method of measuring the induced activity with an end-window Geiger-Mueller counter, a pulse-height analyzer, and grey-wedge spectroscopy is described. (tr-auth)

19019

PHOTOCHEMICAL SEPARATION OF MERCURY ISOTOPES. IV. THE REACTION OF $Hg^{202}6(^3P_1)$ ATOMS, PHOTOEXCITED IN NATURAL MERCURY VAPOR, WITH METHYL CHLORIDE AND ISOPROPYL CHLORIDE. K. R. Osborn and H. E. Gunning (Illinois Inst. of Tech., Chicago and Univ. of Alberta, Edmonton, Can.). Can. J. Chem. 37, 1315-27(1959) Aug.

A detailed investigation has been made of the reaction of $Hg^{202}6(^3P_1)$ atoms, photoexcited in natural mercury vapor (Hg^N), with methyl chloride, at room temperature. Data are also reported on the reaction with isopropyl chloride as substrate. Hg^{202} enrichment in the calomel product is taken as evidence of its formation in the primary quenching reaction. Under static conditions the methyl chloride reaction was found to form calomel with the natural Hg^{202} abundance (29.8%). With increasing flow rate a progressive increase in Hg^{202} abundance was observed. Maximum enrichments were found at fast flow rates, low substrate pressures, and high values for the absorbed light intensity (I_A). The most highly enriched calomel obtained in this study contained 50.4% Hg^{202}. With increasing I_A, a corresponding increase in flow rate was required to achieve maximum Hg^{202} enrichment. The addition of propylene or butene-1 to the methyl chloride stream was found to result in a slight decrease in Hg^{202} abundance over that for the pure substrate. The decrease in enrichment observed at high substrate pressures is shown to be due to Lorentz-broadening effects on the hyperfine absorption contours of Hg^N. The failure to obtain enrichment under static conditions is explained by the depletion in Hg^{202} of the Hg^N in the cell. The investigation shows that there are two primary processes operative in the mercury-$6(^3P_1)$-photosensitized decomposition of alkyl chlorides, in one of which calomel is formed. These processes presumably involve a common short-lived intermediate R—Cl—Hg. (auth)

19020

THE RADIOCHEMICAL POLYMERIZATION OF SOME ALKENES. Ève de Gorski and Gabriel de Gaudemaris (Centre d'Études Nucléaires, Grenoble, France). Compt. rend. 249, 421-3(1959) July 20. (In French)

The polymerization of 1-octene, trans-2-octene, cyclohexene, and 2,4,4-trimethyl-2-pentene under irradiation of 500-kv electrons was studied. The monomer is consumed according to the first order relationship, log (100/x) = kD, where x is the percentage of non-transformed monomer at the time t and D is the radiation dose in watt-hours/gm. The formation of the polymer is also of the first order. The radiochemical yields, in number of monomer molecules transformed per 100 ev, corresponding to various doses are tabulated. The polymer composition for 0.5 and 2 w-hr/gm is also tabulated. The yields support the hypothesis of an ionic mechanism for the polymer formation. The effect of temperature on the reactions is slight. (J.S.R.)

19021

THE USE OF RADIOACTIVE ISOTOPES IN THE USSR. A. V. Topchiev, I. T. Alad'yev, and P. S. Savitskii. Nauka i Zhizn 25, No. 12, 17-22(1958).

Various possibilities for the use of radioactive isotopes are considered. Processes examined are divided into groups such as those with yields of 10 molecules per 100 ev and those which proceed with a high yield (10 to 10^6 molecules per 100 ev) requiring energy only for starting the reaction. Processes of the second group were studied more closely in processes of polymerization, oxidation of organic compounds, halogenation, cracking, and processes occurring under the influence of radiation in polymers. Processes of radiation polymerization were realized with yields of 1,000 and more polymerized molecules of the monomer for each 100 ev of energy. As a practical example, the production of polyethylene by gamma radiation is mentioned. The activation of catalytic processes and the changing of the structure and mechanical properties of metals by radiation are of great importance. Radioactive isotopes are now being widely used for research purposes, for controlling and regulating processes in the ferrous industry, in prospecting for oil, in chemical analysis, and in the field of construction. The use of radioactive isotopes offers new prospects for applying automatic control and regulation of industrial processes. As a result of scientific research more than 4,000 Soviet devices were designed and constructed. Data on the production of isotopes are given. At present, more than 90 radioactive, 170 stable isotopes, and more than 360 compounds labeled with isotopes are being produced in the USSR. (auth)

19022

INVESTIGATING GROUND WATER BY ANALYSIS OF ATMOSPHERIC TRITIUM. Haro von Buttlar. J. Am. Water Works Assoc. 50, 1533-38(1958) Nov.

After every H-bomb explosion, the tritium concentration of rain water exhibits a sharp peak. This results in a universal spike of the ground water, which is indicative of its underground age. A comparison of tritium concentrations in ground waters with that in rain water over a period of time enables the determination of such important hydrological data as the rate of flow of ground water, the fraction of annual recharge, and the age of the ground water with respect to its entry into the ground as rain. The velocity of flow can be calculated from the time delay between the appearance of tritium peaks and the distance between wells. The peak height in well water as compared to the peak height in the corresponding rain water indicates the extent of dilution of recharging rain water with old ground water and yields information as to the size of the ground water reservoir. The width of the well peak as compared with the width of the corresponding rain peak is indicative of the uniformity of the ground water flow. Graphical data are presented for a study of 5 wells near Carrizozo, New Mexico. The tritium method has a promising future for ground water studies provided that further H-bomb explosions do not confuse the tritium peaks of the water. (auth)

19023

PHYSICAL OBSERVATION OF RADIATION-INDUCED INTERMEDIATES. Ralph Livingston (Oak Ridge National Lab., Tenn.). J. Chem. Educ. 36, 349-53 (1959) July.

The substances are cooled to liquid nitrogen temperatures (77°K), irradiated with gamma rays, and the spectra examined. A study of the intermediates formed in methanol and ethanol by gamma-ray irradiation is given. Paramagnetic resonance absorption lines formed by the irradiation of cooled (77°K) sulfuric, phosphoric, and perchloric acids are discussed in relation to the hyperfine interaction of the atomic hydrogen trapped within the solid acid. (C.J.G.)

19024

RADIATION CHEMISTRY OF HIGH POLYMERS. Malcolm Dole (Northwestern Univ., Evanston, Ill.). J. Chem. Educ. 36, 353-9(1959) July.

Irradiation of polyethylene results in the formation of cross-links. Crosslinking increases form stability and resistance to flow at temperatures above the melting point. Degradation of a polymer by radiation decreases the average molecular weight. A comparison of the two

groups (cross-link or degraded polymers) is given. Upon forming a cross-link or a double bond, a molecule of hydrogen must be evolved. Quantitative agreement between the sum of cross-links and double bonds formed and hydrogen liberated has yet to be satisfactorily achieved. The minimum energy required to produce the observed chemical effects in polyethylene is less than 5% of the total energy absorbed. Different methods of radiolytic oxidation are discussed. (C.J.G.)

19025

RADIO OXIDATION OF IRRADIATED SUGARS IN DILUTE AERATED WATER SOLUTIONS. Gyula Binder and András Vincze. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 364-78(1957) May-June. (In Hungarian)

As an effect of ionizing radiation, water solutions of simple sugars undergo radiooxidation. This oxidation is caused by oxidizing radicals formed in water under the influence of radiation which, by attacking the chain end group $-CH_2-OH$, produce unstable uronic peracids for glucose and fructose and stable uronic acids for α-methyl glucoside. The oxidation of glucose and fructose involves an increased hydrogen peroxide formation as compared to pure water. In the case of α-methylglucoside irradiation, somewhat less H_2O_2 is produced than by irradiating pure water. The probable equations for reaction as to the radiooxidation of simple sugars are given. For low-intensity radiation sources the aerated water solution of glucose may be used as a simple and convenient chemical dosimeter. (auth)

19026

ANALYSIS OF RADIOACTIVE SAMPLES. Istvan Fehér and Daniel Vödrös. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 514-20 (1957) Sept.-Oct. (In Hungarian)

The residual radioactive impurities of industrial tracing experiments were analyzed by plotting the decay and γ-spectrum curves and by radiochemical separation. In samples of Fe-59 a considerable amount of Fe-55 and Co-60 isotopes were detected. (auth)

19027

SEPARATION OF STRONTIUM-90 FROM CALCIUM IN MILK. N. A. Myers (Royal Cancer Hospital, London). Nature 183, 1807-8(1959) June 27.

A procedure is described for the separation of calcium-free strontium-90 in high yield directly from liquid milk by means of a cation exchange column. (C.H.)

19028

IRRADIATION OF MUCOPOLYSACCHARIDES WITH ULTRAVIOLET LIGHT AND ELECTRONS. Endre A. Balazs, Torvard C. Laurent, Arthur F. Howe, and Laszlo Varga (Massachusetts Eye and Ear Infirmary, Boston and Harvard Medical School, Boston). Radiation Research 11, 149-64(1959) Aug.

The effect of ultraviolet light and electrons on aqueous solutions of hyaluronic acid, hyaluron sulfuric acid, and heparin was investigated. It was found that irradiation with ultraviolet light causes a decrease in the molecular weight and length of hyaluronic acid prepared from the bovine vitreous body. Irradiation with ultraviolet light causes a decrease in pH and an increase in the reducing power of heparin, hyaluronic acid, and hyaluron sulfuric acid solutions. The cationic dyebinding capacity decreases. The anticoagulation activity of heparin and hyaluron sulfuric acid decreases after ultraviolet irradiation. Irradiation with electrons depolymerizes the large-molecular polysaccharide molecules into low-molecular, dialyzable compounds. It also causes destruction of the hexosamine and hexuronic acid moieties. Both ultraviolet light and electrons form degradation products in the aqueous solutions of hyaluronic acid and heparin with a characteristic ultraviolet absorption band. The absorption maximum is at 267 mμ in neutral and in alkaline solutions and shifts to shorter wavelengths on acidification. (auth)

Separation Processes for Pu and U

19029 AECD-4284

Los Alamos Scientific Lab., N. Mex.

TOTAL CROSS SECTIONS OF TRITIUM, HYDROGEN, AND HELIUM FOR FAST NEUTRONS. J. H. Coon, R. O. Bondelid, and D. D. Phillips. Oct. 1952. Decl. with deletions May 12, 1955. 12p. Contract [W-7405-eng-36]. $3.30(ph), $2.40(mf) OTS.

By using gaseous samples in neutron transmission experiments, the total cross section of tritium was measured over the energy region from 0.3 to 7.0 Mev and at the following additional energies: 14.1, 18.0, 19.1, and 20.0 Mev. A plot of cross section versus neutron energy shows a broad maximum with the greatest value of 2.5 barns at 3.7 Mev. Cross sections for helium were measured in the energy region from 1 to 3 Mev and for both hydrogen and helium at 14.1 Mev. (auth)

19030 CF-59-6-121

Oak Ridge National Lab., Tenn.

SOLIDS ACCUMULATION AND FISSION HEATING IN THE HRT CHEMICAL PLANT UNDERFLOW POT (CO-OP REPORT, FALL QUARTER, 1958). W. E. Dunn. June 10, 1959. 14p. Contract W-7405-eng-26. $3.30 (ph), $2.40(mf) OTS.

A study was conducted to develop equations for calculating fission product heating in the HRT-CP underflow pot from measured temperatures and to attempt to correlate the rate of solids accumulation in the underflow pot with fission heating and reactor power. Using fission heating data calculated from the heat balances developed, several semi-empirical equations relating solids accumulation and heating were tested. In one case an error of no greater than 26% was incurred in the calculation of the total weight of solids collected during chemical plant runs 17-4, 17-5, and 17-6. Further development work will be done on this correlation. (auth)

19031 CF-59-7-75

Oak Ridge National Lab., Tenn.

DECONTAMINATION OF THE PRFR PILOT LEACHING PLANT—PRELIMINARY PROCESS DESIGN. H. A. McLain. July 23, 1959. 9p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

The Turco 4501 process is recommended for the decontamination of the PRFR pilot leaching plant equipment. The caustic-tartrate-nitric acid process is recommended for the decontamination of the cell and the equipment exterior. (auth)

19032 HW-50259(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE REMOVAL OF IODINE FROM DISSOLVER OFF-GAS BY CAUSTIC SCRUBBING. K. V. Seyfrit. May 20,

1957. Decl. with deletions July 7, 1959. 6p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

Revised limits for radioactive iodine emission have made necessary the construction of supplementary iodine removal facilities for the Purex plant. An installation consisting of an acid absorber and caustic scrubber was found to have an efficiency greater than 99.85% under certain conditions. (W.L.H.)

19033 HW-55419

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TECHNOLOGY FOR THE REPROCESSING OF NON-PRODUCTION REACTOR FUELS, BUDGET ACTIVITY 2790. Quarterly Report. V. R. Cooper. Mar. 17, 1958. Decl. June 25, 1959. 9p. Contract [W-31-109-Eng-52]. $1.80(ph), $1.80(mf) OTS.

This is the first in a series of quarterly reports on the research and development work carried out for activity 2790 — Separations Development for Non-Production Reactors. By January, 1962, Hanford is to be prepared to process the fuels from the power reactors which employ depleted or slightly enriched uranium fuels. At the present time, Hanford is planning to process the fuel from the following reactors: Yankee, Dresden, CPPD, Piqua, Chugach, PRDC, and Northern States. Batch studies were made to determine the requirements for removing chloride from aqua regia dissolver solution by solvent extraction. Preliminary dissolution and corrosion rates are given for stainless steel jackets in HNO_3–NF systems. The solubility of UF_4 in boiling Zirflex solutions (NH_4HF) containing dissolved Zr is given. Zirflex pilot plant studies were initiated on the dissolution of Zircaloy metal with aqueous NH_4HF solution. A welded Haynes-25 coupon showed no visible preferential attack after exposure to 5M HNO_3–2M HCl for 200 hours. The corrosion rate of 304-L stainless steel exposed for 312 hours to 6M NH_4HF under heat transfer conditions was 1.6 mils/month. (W.L.H.)

19034 KLX-10080

Vitro Labs., West Orange, N. J.

IODINE CHEMISTRY, KRYPTON SOLUBILITY, CHEMICAL PROCESSING. Final Report. Vitro Job 1087. Robert A. Keeler, Charles J. Anderson, Stanley J. Klach, and Raymond M. Chappel. Oct. 31, 1957. Decl. Aug. 6, 1959. 151p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 535. $22.80 (ph), $7.20(mf) OTS.

The solubility of Kr under reactor conditions to provide a basis for estimating the concentrations and location of fission product rare gases in a homogeneous reactor was investigated. Selected chemical and physical properties of iodine to predict the behavior of iodine in a reactor are given. A secondary objective was the development of a process for removal of iodine, the precursors of xenon, as a means of controlling xenon poisoning. A bench-scale study is described of the ORNL process to develop a simple short-term process for high uranium recovery from a hydroclone underflow slurry, using a peroxide precipitation step as a means of separating uranium from soluble contaminants. (W.L.H.)

19035 NP-7754

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

PRETREATMENT OF FUEL ELEMENTS. Technical Report No. 48; Chapter 130. E. Detilleux. [1958]. 10p. $1.80(ph), $1.80(mf) OTS.

A review is presented of pretreatment methods with special attention to those useful at Eurochemic. Mechanical and chemical decanning methods presently in use or proposed for Al-, Mg-, stainless steel-, and Zr- or Zr alloy-jacketed fuels are discussed. Darex, Sulfex, and Zirflex processes are included along with special methods for U–Mo and U–Zr fuels. (T.R.H.)

19036 NP-7775

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

BASIC CHEMISTRY. Technical Report No. 38, Chapter 120. Sten Ahrland. 1959. 33p. $6.30(ph), $3.00(mf) OTS.

An attempt is made to expound the basic chemistry of the different reprocessing steps chosen for the Eurochemic plant. In some cases alternatives are given when the exact reaction courses are unknown. (C.J.G.)

19037 NP-7781

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

INTRODUCTION. SUMMARY OF WORK AND PLANS. Report ED-I, Chapter 100. E. Haeffner. 1959. 30p. $6.30(ph), $3.00(mf) OTS.

A summary of the Eurochemic plans and principles for reprocessing plant design and construction is given. Flowsheets are given for the general scheme and fuel recovery processes. Plans prepared by SRO for future Eurochemic plant and research laboratories are included. (C.J.G.)

19038 NP-7783

European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.

ACTIVITY BALANCE. Technical Report No. 51, Chapter 160. E. Detilleux, A. Redon, and M. Zifferero. [nd]. 9p. $1.80(ph), $1.80(mf) OTS.

Tables of the Eurochemic plant activity balance are presented. The activity balance is given in the form of specific activity in curies per liter and activity in curies per day. The α emitters are expressed in curies, assuming 1 g U = 3.36×10^{-7} α curies and 1 g Pu = 6.17×10^{-2} α curies. (auth)

19039

QUANTITATIVE DETERMINATION OF THE URANIUM CONTENT OF URANIUM ORES TECHNOLOGICAL PRODUCTS BY ION EXCHANGE-COMPLEXON SEPARATION. Miklós Fodor. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 445-57 (1957) July-Aug. (In Hungarian)

An ion exchange-complexion separation method was developed for the removal of interfering elements in the determination of the uranium content of recovery solutions. By adding (ethylenediamine)tetraacetic acid to the solution, most of the interfering elements can be brought into an anionic complex. Adjusting the solution to pH 7 and letting it pass through an Amberlite IRC-50 type cation exchanger of hydrogen form, the uranium remains on the column whereas the interfering elements pass into the effluent. The method was successfully applied in analyzing the recovery solutions of uranium ores. (auth)

19040

ON THE COMPLEX FORMATION IN THE SYSTEM $UO_2(NO_3)_2$–$KHCO_3$–H_2O_2–H_2O. E. V. Komarov. Zhur. Neorg. Khim. 4, 1313-23(1959) June. (In Russian)

CONTROLLED THERMONUCLEAR PROCESSES

19041 NP-7848
Defense Atomic Support Agency. Field Command, Albuquerque, N. Mex.
SUMMARY OF SHERWOOD ACTIVITIES. Charles W. Hulburt and Wendell S. Winn. July 31, 1959. 46p.

A brief summary of Sherwood activities is presented. Background information necessary to understand the problems involved is given. Sketches and short explanations of the functioning of the experimental devices are included. Current status of the program at Princeton, ORNL, NRL, NYU, UCRL, LASL, and Stevens is reviewed. Full-scale thermonuclear reactors are discussed. (W.D.M.)

19042 NRL-5391
Naval Research Lab., Washington, D. C.
RECENT RESULTS IN PLASMA PHYSICS RESEARCH. A. C. Kolb and W. R. Faust. Aug. 13, 1959. 24p.

The results of recent experimental work with the 285,000 joule condenser bank are described. It is shown that a stable plasma was obtained and confined for times longer than that required to reach the maximum current. Experimental data on the duration of the neutron pulse agrees with theoretical calculations of plasma confinement time. If particle densities obtained from measurements of optical bremsstrahlung are used in the calculations, the neutron yield can be accounted for by an ion temperature of about 2 kev which is consistent with a pressure balance carried out at the final compression. (auth)

19043 AEC-tr-3769
THE PROBLEMS OF CONTROLLING THERMONUCLEAR PROCESSES. E. I. Dobrokhotov. Translated by A. L. Monks (Oak Ridge National Lab.) from Priroda 48, No. 1, 103-8(1959). 17p. (Includes original, 6p.). $3.30(ph), $2.40(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 9865.

19044 AEC-tr-3772
RESEARCH ON CONTROLLED THERMONUCLEAR REACTIONS IN THE USSR. L. A. Artsimovich. Translated by A. L. Monks (Oak Ridge National Lab.) from Vestnik Akad. Nauk S.S.S.R. 29, No. 1, 11-23(1959). 30p. (Includes original, 13p.). $4.80(ph), $2.70(mf) JCL or LC.

Methods for using a magnetic field for thermal isolation and heating of a plasma may be divided into two main groups—the first of these consists of methods for accelerating the plasma by electrodynamic forces and the other methods for obtaining equilibrium plasma configurations. Results obtained by Soviet scientists in theoretical and experimental investigations on various aspects of the methods are treated. Problems pertaining to the general properties of future thermonuclear reactors are discussed. (W.D.M.)

19045
SOME REMARKS ON THE GENERATION OF NUCLEAR POWER BY CONTROLLED FUSION PROCESSES. A. Szalay and D. Berényi (Hungarian Academy of Sciences, Debrecen, Hungary). Acta Phys. Acad. Sci. Hung. 10, 39-55(1959).

Energy production and the radiation losses of a thermonuclear system are discussed. A diagram is given with which the number of fusions and the energy production per sec and cm^3 at any plasma density and for suitable temperatures can be determined. A circumstantial discussion follows on the operational conditions of the possibly practicable thermonuclear reactors. (auth)

19046
ON THE PROBLEM OF AN ELECTROMAGNETIC WALL. Lajos Pócs and György Schmidt. Magyar Tudományos Akad. Kozponti Fiz. Kutató Intézetének Közleményei 5, 64-72(1957) Jan.-Feb. (In Hungarian)

The possibilities and problems of an electromagnetic wall, required for the realization of a thermonuclear reactor, are discussed in connection with some models. It is shown that a tight wall could be constructed only on the basis of magnetohydrodynamics. (auth)

19047
DRAFT OF A FUSION REACTOR. Károly Simonyi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 99-106(1957) Jan.-Feb. (In Hungarian)

A description of a possible fusion reactor according to the present state of knowledge is given. The purpose is to give a correlative discussion of the problems to be solved. (auth)

19048
ON THE STAR-LIKE FUSION REACTOR. Károly Simonyi and Miklós Uzsoki. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 344-58(1957) May-June. (In Hungarian)

A possible steady state of a deuterium–tritium mixture in plasma state confined at constant pressure in a spherical container is considered. The temperature chosen for the plasma sphere center is in the vicinity of the temperature belonging to the maximum of thermonuclear energy production, the temperature of the external wall being fixed at about a few thousand degrees. Although the dimensions obtained are on a terrestrial scale, technically the realization of a fusion reactor of this type is found to be impossible. (auth)

19049
THERMONUCLEAR MAGNETIC TRAPS. D. A. Panov and N. N. Semashko. Priroda 48, No. 7, 13-18(1959) July. (In Russian)

The mechanism and principle of magnetic traps shaped as a straight column with longitudinal magnetic fields intensified at the ends is described. The reflection and drift of particles, the behavior of plasma, the methods for creating plasma in magnetic traps, and the process of ion accumulation in traps are discussed. The general design of the trap "Ogra" is included. (R.V.J.)

CRITICALITY STUDIES

19050 CF-59-7-66
Oak Ridge National Lab., Tenn.
MULTIGROUP DIFFUSION THEORY CALCULATIONS FOR RECENT CRITICAL EXPERIMENTS. C. W. Nestor, Jr. July 21, 1959. 13p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

In connection with the program of the measurement of eta for U^{233}, several critical experiments were performed with light water solutions of uranyl nitrate in an essentially bare sphere 27 inches in diameter. Results

of two multigroup-diffusion-theory calculations for the above experiments are presented. Assumed cross sections, material concentrations, detailed neutron balances, and a comparison with elementary theory are included. The agreement between the calculated and experimental multiplication constants is excellent for the multigroup calculation but only fair for the elementary calculation. The latter method overestimates the fast leakage so that the computed multiplication constant is less than that found experimentally. (auth)

19051 CF-59-7-87
Oak Ridge National Lab.
MULTIPLICATION MEASUREMENTS WITH HIGHLY ENRICHED URANIUM METAL SLABS. J. T. Mihalczo and J. J. Lynn. July 27, 1959. 35p. Contract [W-7405-eng-26]. $6.30(ph), $3.00(mf) OTS.

A series of neutron multiplication measurements with arrays of 1 by 8 by 10 in. slabs of 93.4% U^{235}-enriched uranium metal was made to provide data from which safety criteria for the storage of these fissile units can be established. Each slab contained 22.9 kg of U^{235}. A maximum of 125 units was assembled. The arrays studied were cubic lattices of the units and were usually parallelepipedal in shape. Arrays were both unmoderated and Plexiglas-moderated and were surrounded in most cases by a 1-in.-thick Plexiglas reflector. The lattice densities (ratio of fissile unit volume to lattice cell volume) were between 0.023 and 0.06. Unmoderated lattices with a density of 0.06 would require 145 ± 5 units for criticality, while those with a density of 0.023 would require 350 ± 30 units. In lattices in which the fissile units are separated by 1 in. of Plexiglas, approximately 27 units would be required for a critical array with a lattice density of 0.06 and about 75 units for a density of 0.023. Distributing Foamglas (containing 2% boron) throughout a moderated array increased the critical number of fissile units by a factor of 5, while Styrofoam had a small effect. (auth)

GEOLOGY AND MINERALOGY

19052 RME-2053
Grand Junction Operations Office. Production Evaluation Div., AEC.
AIRBORNE RECONNAISSANCE PROJECT, RUBY RANGE AND SWEETWATER BASIN, MONTANA. R. G. Pruitt, Jr. and D. N. Magleby. Apr. 1958. 13p. $0.50 (OTS).

A low-level airborne radioactivity survey of parts of Beaverhead and Madison Counties in southwestern Montana was undertaken from June 6 to October 14, 1955. Flying centered around the Ruby Range-Sweetwater Basin area and concentrated on the Precambrian metamorphic complex and Tertiary lake-bed sediments. No commercial uranium deposits were discovered, and no extensions were found of the few known small occurrences. Five areas of high background detected through the survey were investigated on the ground. (auth)

19053 RME-2061(Pt. I)
Grand Junction Operations Office. Salt Lake Branch Office, AEC.
SOME THORIUM DEPOSITS IN WESTERN MONTANA AND EAST-CENTRAL IDAHO. Wayne S. Moen. Mar. 1957. 31p. $1.00(OTS).

Significant deposits of thorium occur throughout an area 7 miles long and 4 miles wide in the Lemhi Pass area of south-western Montana and east-central Idaho. A small deposit of thorium has also been recently exposed in the Duck Creek area of Broadwater County, Montana. In the Lemhi Pass area, the thorium mineral, thorite, is found in quartz-hematite veins that cut quartzites of the Belt series of Precambrian age. The thorite is fine grained and admixed with iron oxides; it is accompanied by minor amounts of uranium and rare earths. The Little Brown Egg thorium deposit in the Duck Creek area consists of pods and pockets of massive thorite occurring in aplite dikes which cut limestones of the Belt series. The average grade of 7 thorium deposits in the Lemhi Pass area and 1 deposit in the Duck Creek area is 0.72% thorium oxide. Most deposits are the narrow vein type. One deposit in the Lemhi Pass area contains a significant amount of ore with an average grade of about 1% thorium oxide. (auth)

19054 RME-2063(Pt. 1)
Grand Junction Operations Office. Salt Lake Branch Office, AEC.
GEOLOGY OF THE URANIFEROUS BOG DEPOSIT AT PETTIT RANCH, KERN COUNTY, CALIFORNIA. W. A. Bowes, W. E. Bales, and G. M. Haselton. Oct. 15, 1957. 30p. $1.00(OTS).

Uranium associated with peat humus was discovered in a boggy meadow in the Sierra Nevada of Kern County, California, in the fall of 1955. The ore is an organic soil composed of growing grasses, mosses, and bog plants as well as peat mixed with detrital silt and sand derived from the underlying Jurassic (?) quartz diorite. The uranium is confined to the organic material and probably exists as a metallo-organic complex. No uranium minerals have been identified. The bog is presently accumulating in a fault-depressed area continuously moistened by a series of springs which mark the position of the concealed Little Poso Creek fault. The spring waters contain an average of 0.11 ppm (parts per million) uranium, over 10 times that of local drainage waters. The radioactive material is characterized by extremely low gamma radioactivity which may be due to the recent emplacement of uranium by spring waters. Laboratory tests show that the ore is not amenable to present metallurgical processes. Preliminary roasting is necessary to obtain high extraction of the uranium. Tests indicate that the ore may be upgraded over 100 percent by first separating the detrital minerals from the organic matter, then roasting the organic fraction to ash. Roasting alone serves to upgrade the raw ore 25 percent. Two geologically similar uraniferous bogs are known in Fresno and Madera Counties, California, 100 miles north of the Pettit Ranch. Two other bogs have been reported. The possibility for finding additional deposits of this type is favorable as boggy meadows and springs are common in fault terrane of the Sierra Nevada. Primary ore controls at the Pettit Ranch deposit are: (1) waters of high uranium content, (2) a suitable collector for the uranium (peat), and (3) restricted circulation. These are important guides for prospecting. Methods of prospecting, such as structural studies aimed at checking faults for springs and depressed boggy areas, systematic water sampling, or merely ground reconnaissance of boggy areas, could be employed. The effectiveness of airborne radiometric prospecting methods is limited by the low gamma radioactivity of the bog ore. (auth)

19055
A COMPARATIVE STUDY OF TEN MONAZITES.

Martin W. Molloy (Columbia Univ., New York). Am. Mineralogist 44, 510-32(1959) May-June.

Optical, x-ray, and differential thermal methods are used to compare monazite recently discovered near Chester, New Jersey, with monazite from nine other localities. Indices of refraction, 2V and birefringence have been determined. X-ray-diffraction patterns have been measured, indexed, and their relationships determined. Micro-camera diffraction patterns have provided information on the alteration of monazite. The application of x-ray fluorescence to the quantitative analysis of rare earth elements in monazite is shown to be feasible through sensitivity to minor variations caused by crystal fractionation. Theoretical factors which interfere with precise x-ray fluorescence, quantitative analysis of rare earth elements in monazite are examined. The effect of two types of alteration, intercrystalline and intracrystalline, upon the differential thermal pattern of monazite is observed. (auth)

19056

NINGYOITE, A NEW URANOUS PHOSPHATE MINERAL FROM JAPAN. Tadashi Muto, Robert Meyrowitz, Alfred M. Pommer, and Toru Murano (Atomic Fuel Corp., Tokyo). Am. Mineralogist 44, 633-50(1959) May-June.

Ningyoite, $U_{1-x}Ca_{1-x}R.E._{2x}(PO_4)_2 \cdot 1-2H_2O$, where x is about 0.1 to 0.2, is a new uranous mineral which occurs in an unoxidized zone of the Ningyo-toge mine, Tottori Prefecture, Japan. It coats pyrite and other minerals, or fills cavities and cracks in the ore. Ningyoite is acicular or elongated lozenge-shaped, and is very fine grained. The color is brownish green or brown in transmitted light, and faint pleochroism, darker in the Z direction, is observed. Extinction is parallel with positive elongation. The index of refraction varies and is about 1.64. Double refraction seems to be low. The x-ray pattern of the mineral resembles that of rhabdophane, $R.E.PO_4 \cdot H_2O$, but whereas rhabdophane has hexagonal symmetry, ningyoite is pseudohexagonal, orthorhombic, and the space group is probably P222 (D_2^1). The unit cell has dimensions a = 6.78 ± 0.03 A, b = 12.10 ± 0.05 A, and c = 6.38 ± 0.03 A, and contains 3 formula weights. (auth)

19057

RELATIONSHIP OF CARBONATE CEMENT TO LITHOLOGY AND VANADIUM–URANIUM DEPOSITS IN THE MORRISON FORMATION IN SOUTHWESTERN COLORADO. N. L. Archbold (Univ. of Michigan, Ann Arbor). Econ. Geol. 54, 666-82(1959) June-July.

Carbonate content was determined for 888 samples from the Salt Wash member of the Morrison formation in the Slick Rock and Uravan mining districts in southwestern Colorado. The carbonate content of most samples was determined semiquantitatively by calculating the amount of calcite equivalent to the mass of carbon dioxide evolved when the samples were treated with 3 normal hydrochloric acid. The content of some samples was determined in the course of standard chemical assays and the content of others was visually estimated. Samples were assigned to categories or "rock types" on the basis of gross lithology, vanadium–uranium content, degree of epigenetic alteration, and degree of oxidation through weathering. The average carbonate content was determined for each rock type, and the distribution of carbonate around oxidized and unoxidized ore was investigated. Results indicate that sandstone in the uppermost (ore-bearing) part of the Salt Wash member contains 2.5 to 3.0% carbonate, whereas sandstone in the lower (generally barren) part of the Salt Wash member contains about 13% carbonate. Altered mudstone in the Salt Wash member contains about 4% carbonate, and unaltered mudstone about 7%. Carbonate-rich zones in sandstone adjacent to contacts with mudstone may be of syngenetic or early diagenetic origin, whereas carbonate-rich zones associated with ore bodies may be genetically related to the ore deposits. Where the sandstone has been subjected to weathering, the over-all distribution of carbonate does not seem to have been greatly affected. (auth)

19058

THE PROBLEM OF THE ABSOLUTE AGE OF THE PRE-CAMBRIAN OF THE BALTIC SHIELD. E. K. Gerling and A. A. Polkanov. Goekhimiya, No. 8, 695-717(1959).

A number of absolute age determinations on mica from the Kola peninsula, Kareliya, Finland, and the Western White Sea region were made by the K/Ar and Rb/Sr methods. A survey of the results obtained is given diagrammatically. Four large cycles of sedimentation were found for the eastern regions. Five or six intrusions of acid magma followed the orogenic movements. (J.S.R.)

19059

EXPERIMENTING THE CALCIUM METHOD FOR THE DETERMINATION OF ABSOLUTE AGE OF SYLVITES. N. I. Polevaya, N. Ye. Titov, V. S. Belyayev, and V. D. Sprintsson. Geokhimiya, No. 8, 718-26(1958).

The possibility of employing the calcium method for age determinations was investigated. Samples of white sylvite were used for the investigation. The calcium was separated by an ion exchange technique, and the Ca^{44}/Ca^{42} ratio was determined. The results are tabulated. For comparison the age was also determined by the K/Ar method. The results are in good agreement with the results of the calcium method. (J.S.R.)

19060

THE INFLUENCE OF THE STRUCTURE OF MINERALS ON ISOMORPHOUS REPLACEMENTS IN SILICATES OF IGNEOUS ROCKS. L. V. Tauson. Geokhimiya, No. 8, 735-42(1958).

The effect of the silicate lattices on the distribution of rare elements in igneous rocks is discussed. The ratio of rubidium, barium, and lead to potassium in biotites and potassium feldspars of granitoids, the lithium–magnesium ratio in iron–magnesium silicates, and the distribution of germanium in silicates are considered in detail. The distribution of lithium and magnesium indicates an effect of the geochemical development in the magmatic process. (TCO)

19061

ON THE ZIRCONIUM-HAFNIUM RATIO IN ROCKS OF THE LOVOZERSKII MASSIF. V. I. Gerasimovskii, A. M. Tuzova, and I. D. Shevaleyevskii. Geokhimiya, No. 8, 743-8(1958).

Rock samples from three magmatic complexes of the Lovozerskii massif of the Kola peninsula were examined to determine the zirconium and hafnium content. The results are tabulated and show that the contents range from 0.07 to 2.31% ZrO_2 and from 0.015 to 0.057% HfO_2. The variations in the zirconium/hafnium ratio are insignificant. Zr and Hf are concentrated in late magmatic complexes with 0.167%, 0.29%,

and 1.49% ZrO_2 in the first, second, and third complexes, respectively. Agpaitic rocks have a higher Zr and Hf content than miascite rocks, but no relationship could be found between sodium-potassium and zirconium-hafnium contents. (TCO)

19062

ON THE DISTRIBUTION OF RARE ELEMENTS IN MINERALS OF RARE-METAL GRANITE PEGMATITES. N. A. Solodov. Geokhimiya, No. 8, 749-56(1958).

The distribution of the elements lithium, cesium, rubidium, tantalum, niobium, and beryllium were determined in the minerals albite, microcline, quartz, turmaline, muscovite, beryl, pollucite, lepidolite, spodumene, garnet, apatite, and clevelandite of two pegmatite veins. The dispersion of the elements was studied. The average content of the rock-forming minerals is 0.0003% Nb, and Ta, 0.0009% Be, 0.018% Li, 0.107% Cs, and 0.64% Rb. The reasons for this dispersion are discussed. (J.S.R.)

19063

RESULTS OF GEOLOGIC EXPLORATION BY CORE DRILLING, 1953, LAND-PEBBLE PHOSPHATE DISTRICT, FLORIDA. James B. Cathcart and Lawrence J. McGreevy. U. S. Geol. Survey Bull. 1046-K. 1959. 82p., 19 illus.

A program of core drilling to delimit the uranium- and phosphate-bearing strata of the land-pebble phosphate district and to study the stratigraphic relations of the Bone Valley formation was carried out. A series of cross sections, an isometric fence diagram, and a series of tables summarize the lithologic, stratigraphic, analytical, and economic data derived from the drilling. (J.E.D.)

19064

REGIONAL GEOPHYSICAL INVESTIGATIONS OF THE URAVAN AREA, COLORADO. GEOPHYSICAL FIELD INVESTIGATIONS. H. R. Joesting and P. Edward Byerly. U. S. Geol. Survey Profess. Paper 316-A. 1958. 20p., 3 illus. $1.25.

From the assembled geophysical and geologic data, it was possible to gain additional information on general and specific aspects of the geology of the Uravan district. The information includes data on the configuration and major trends of the basement rocks, the approximate thickness and structure of the sedimentary rocks, the migration of salt, and the configuration of the salt anticlines. (J.E.D.)

19065

GEOLOGY AND ORE DEPOSITS OF THE CHICAGO CREEK AREA, CLEAR CREEK COUNTY, COLORADO. J. E. Harrison and J. D. Wells. U. S. Geol. Survey Profess. Paper 319. 1959. 97p., 13 illus.

The Chicago Creek Area in Clear Creek Co., Colo., is located about three miles southwest of Idaho Springs and forms a part of the Front Range mineral belt, a northeast-trending belt of coextensive veins and porphyry intrusives of the Tertiary age. The general geology, structure, ore deposits, location of ore bodies, and description of mines are reviewed. Maps, diagrams, and tables are included. (J.E.D.)

HEALTH AND SAFETY

19066 AECU-4277

Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.

PROCEEDINGS OF THE SECOND INDUSTRIAL MEDICAL CONFERENCE, CARBIDE AND CARBON CHEMICALS CORPORATION, HELD AT K-25 PLANT DISPENSARY, OAK RIDGE, TENNESSEE, AUGUST 18-20, 1948. 119p. (KZ-6778). $16.80(ph), $5.70(mf) OTS.

Topics discussed at this conference include the pharmacology of uranium, the control of industrial uranium exposures, radiation monitoring in industrial plants, the medical supervision of workers in atomic energy plants, lead poisoning, air analysis in the control of industrial lead exposures, industrial mercurialism, mercury vapor hazards in an instrument shop, thallium poisoning, pulmonary edema, the use of oxygen in the treatment of pulmonary edema, treatment of chemical injuries of the eye, the management of bearing problems in industry, the management of visual problems in industry, and the use of I.B.M. equipment for developing routine medical department reports as well as for carrying on special statistical studies. (C.H.)

19067 AECU-4294

Nevada Test Organization. Off-site Radiological Safety Activities, AEC.

SPECIAL REPORT ON OPERATION OF KIWI-A REACTOR. Period covered: May, June, July, 1959. Oliver R. Placak. July 28, 1959. 34p. $6.30(ph), $3.00(mf) OTS.

The Public Health Service off-site Radiological Safety Organization provided coverage during the period of operation of the Kiwi-A Reactor by the LASL in May and June, 1959. While the magnitude of the Off-site Rad-Safe operation was not comparable to full-scale weapons activities, the capability of coverage was extensive. Data collection was accomplished both through portable monitoring instruments and fixed sampling instrumentation stations. (W.D.M.)

19068 AERE-Bib-122

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

TECHNIQUES FOR HANDLING RADIOACTIVE MATERIALS. A BIBLIOGRAPHY. A. C. Foskett. June 1959. 37p. $0.70(BIS).

The scope is restricted to the actual handling of radioactive materials and does not include the materials themselves except incidentally. The sources checked include Nuclear Science Abstracts and the indexes at AERE Harwell, the period covered being July 1953 to December 1958. Previous work in the field is covered by AERE Inf/Bib 53 and Supplements. (auth)

19069 ANL-5967

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1958. May 1959. 223p. Contract W-31-109-eng-38. $3.50(OTS).

Progress is reported in the following studies: the decay time of irradiated scintillation solutions; the performance of twin scintillation detectors for measuring neutrons in the presence of gamma radiation; the measurement of cosmic ray neutron background with a twin scintillation fast neutron spectrometer; the diffusion and absorption of gases in plastic-walled ionization chambers; calculations of the drift velocity and the energy distribution of electrons of helium, neon, argon, and nitrogen under the action of a uniform electric field; the development of equipment for tracer studies of atmospheric diffusion; the deposition and retention of isotopes of actinium, radon, radium, and thorium in bone; the effects of age on calcium metabolism in bone;

the development of a mathematical theory of the retention of radioactive elements by bone; the development of a reproducible method for directly determining individual alpha activities in mixtures; the design of a flow-gas Geiger counter; a survey of the natural radioactivity of a number of municipal water supplies; measurements of activity in individuals by means of the human spectrometer; measurements of the cesium-137 content of human subjects; measurements of the atmospheric content of cesium-137 as a function of time; a comparison of background radioactivity at the Laboratory and a site approximately 250 feet below grade level; development of a spectrometric method for measurements of radioactivity in soil; the effects of meteorological variables on the distribution of radon in the atmosphere; and studies of atmospheric diffusion. A list of publications during the period is included. (For preceding period see ANL-5919.) (C.H.)

19070 IGIS-37(RD/R)

United Kingdom Atomic Energy Authority. Industrial Group H. O., Risley, Lancs, England.

BERYLLIUM HEALTH HAZARDS AND PROTECTION. U. R. M. Chadwick. May 2, 1959. 31p.

Comprehensive selection is presented of some 222 references to classified and unclassified literature on the subject and includes a selection of general references on the properties, uses, and fabrication of the metal. The references were obtained from the U.K.A.E.A. abstracts index to classified British, Canadian, and American reports, and Nuclear Science Abstracts (to June, 1958). (auth)

19071 KAPL-M-HP-1

Knolls Atomic Power Lab., Schenectady, N. Y.

HEALTH PHYSICS SEMIANNUAL REPORT FOR JANUARY–JUNE 1959. W. H. Truran, comp. 20p. Contract W-21-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

No exposure of personnel to external or internal radiation exceeded the quarterly or average annual exposure limits recommended by the National Committee on Radiation Protection and Measurements. The maximum external exposure for the first and second quarters of calendar year 1959 were 50% and 34%, respectively, of the quarterly limits. A total of 4.5 curies of fission product radioactivity was released to the Mohawk River without adverse affect on the utilization of the river water for recreation or as a source of drinking water. Less than 63 mc of fission product radioactivity were released to the atmosphere from KAPL ventilation air exhaust stacks. Radiocontamination levels detected in environmental air, rain, vegetation, and soil followed patterns similar to those reported in the past resulting from local waste storage operations and fall-out from weapon tests. An automatic mechanical sample changer and radioactivity counter was placed in operation in June to replace manually operated counting equipment, permitting unattended off-shift counting and substantially reducing counting room operations expense. Developments in personnel area dosimetry included the design, construction and testing of a neutron analyzer to evaluate the neutron energy spectrum and dose received by personnel from a criticality or reactor incident. Irradiations of the analyzer were made using the Van de Graaff accelerator at neutron energies of 2.1, 3.0, 4.7, and 5.2 Mev. A borated circular parallel plate fast neutron dosimeter was constructed, and theoretical calculations of its sensitivity were made using Monte Carlo techniques and the GMC code on the IBM-704. The above borated chamber in addition to the resonance threshold foil badge and a film foil moderator assembly were tested for neutron energy response using a Van de Graaff positive ion accelerator. Using various neutron phosphor-film combinations it was possible to measure thermal neutron exposures of the order of 2 mrem and fast neutrons of 200 mrem. Other developments involved the conversion of the cutie pie survey instrument to a tissue equivalent detector, the construction of a tissue equivalent proportional counter and associated system to measure the doses in a radiation field as a function of LET and RBE, and the continuation of the film-fading experiments. (For preceding period see KAPL-2060.) (C.H.)

19072 LAMS-596

Los Alamos Scientific Lab., N. Mex.

PROBLEMS OF AIR-BORNE CONTAMINATION IN HANDLING PuF_4 POWDERS. W. R. Kennedy, A. Dumrose, and A. Ludwig. July 31, 1947. Decl. Apr. 27, 1959. 18p. $3.30(ph), $2.40(mf) OTS.

Studies were made of the air-borne contamination present during the operations of reducing plutonium tetrafluoride powder to the metal. Equipment design changes were made and operation technique changes were made until the amount of contamination present during operations was well below tolerance levels. Conclusions reached were that all operations with active materials should be carried on in closed, vented systems, and sequent operations should be connected in series so as to eliminate transfers of the material through the open room. Where such transfers cannot be eliminated clean, disposable containers should be used to make the transfers. (auth)

19073 M-7089

[Department of Agriculture. Soil Survey Labs., Beltsville, Md.]

SOIL SAMPLING PROGRAM FOR DETERMINING WORLD-WIDE DISTRIBUTION OF STRONTIUM 90. Summary of Remarks to be made by Lyle T. Alexander to the Conference on the Passage of Fission Products through Food Chains at Harwell, England, September 23, 1958. 13p. $3.30(ph), $2.40(mf) OTS.

The world-wide soil sampling program for strontium-90 is reviewed. The influence of rainfall on the fall-out of strontium-90 is stressed. A list is included of stations where samples were collected from 1954 through 1958. (C.H.)

19074 M-7090

Weather Bureau, Washington, D. C.

ANALYSIS OF STRATOSPHERIC STRONTIUM-90 MEASUREMENTS. L. Machta and R. J. List. Mar. 1959. 22p. $4.80(ph), $2.70(mf) OTS.

Various hypotheses advanced concerning the distribution of fall-out radioactivity in the stratosphere are reviewed. Estimated levels are compared with observed stratospheric concentrations. Project Ashcan, the program of the Atomic Energy Commission to measure the radioactive dust content of the stratosphere by means of balloon-borne filters, is discussed. The filters are analyzed for gross beta activity and for barium-140, zirconium-95, cerium-144, cesium-137, strontium-89, and strontium-90. Emphasis is placed on strontium-90 levels. An inspection of the data shows that there is a large variability. This variability may be real and a measure of the true state of affairs in the stratosphere, or it may be a function of the collection or analysis techniques. Some of the variability is attributed to re-

cent injections into the stratosphere. Problems of collection and comparisons of data from theoretical and laboratory studies with data from collections made by aircraft and balloons are discussed. Data are tabulated from a series of measurements on filter efficiency. Data are included on the average concentration of debris in the stratosphere as a function of altitude and latitude for two six-month periods, January through June 1957 and January through June 1958. (C.H.)

19075 M-7123

Department of Agriculture.

FIELD TRIAL OF TREATMENTS AFFECTING STRONTIUM UPTAKE. [1954]. 8p. $1.80(ph), $1.80(mf) OTS.

The uptake of strontium-89 by soybeans and bluegrass was measured following artificial contamination of the soil surface in a field experiment. The effects of various combinations of tillage treatments and additions of lime on this uptake were determined. The uptake of calcium by the crops was determined, and the ratios of strontium-89 to calcium were calculated for the soil and crops. Data are tabulated. (C.H.)

19076 RISLEY-5006/21

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE INDUSTRIAL TOXICOLOGY OF FLUORINE AND CERTAIN FLUORIDES. E. F. Edson. Oct. 1949. 33p.

A review is presented of the major toxicological data concerning fluorine, hydrofluoric acid, uranium hexafluoride, and certain other fluorides. Major characteristics of the four groups of fluorine compounds and their fate in the body are summarized. Types of injuries caused by various fluorine compounds are discussed. Medical information on toxicological and therapeutic aspects of fluorine hazards is given. (C.J.G.)

19077 TID-5559

Division of Biology and Medicine. Civil Defense Liaison Branch, AEC.

TECHNICAL CONSIDERATION ON SURVIVAL MEASURES AND REDUCTION OF CASUALTIES. Robert L. Corsbie. Aug. 1959. 46p. $0.50(OTS).

Presented at the Hearings on the Biological and Environmental Effects of Nuclear War, before the Special Subcommittee on Radiation, Joint Committee on Atomic Energy.

The current and projected nuclear energy civil effects program is summarized. Evaluations, conclusions, and new data on the nature of radioactive fall-out and its effects on man are included. The program of studies on the effects of nuclear detonations is described. It is stated that the AEC believes that its most effective contribution to national self-protection will be made by furnishing technical assistance and information essential to non-military defense plants and operations. An evaluation of the information on weapons effects available in the open literature showed that there is substantial information of practical value already published, which can be used in building a national self-protection program. A cooperative program among a number of government agencies and the Veterans Administration is outlined. The need for a biomedical test program and supporting laboratory work is postulated. (C.H.)

19078 WT-1482

Federal Civil Defense Administration, [Battle Creek, Mich.].

FIELD RADIOLOGICAL DEFENSE TECHNICAL OPERATIONS. Project 36.1 [of] OPERATION PLUMBBOB. B. C. Killian and A. H. Emmons. Mar. 1958. 31p. $1.00(OTS).

A training project was conducted to provide orientation, instruction, and practical training in radiological defense technical operations associated with a fall-out radiation field. Techniques employed were foot surveys, vehicle surveys, and aerial surveys utilizing standard FCDA radiation detection instruments and other equipment. During field exercises data were collected for the evaluation of the several monitoring techniques on the beta-gamma ratio and in support of the technical projects conducting decontamination studies and aerial survey techniques. (auth)

19079 AEC-tr-3746

RADIOACTIVE CONTAMINATION OF FISH IN WATER CONTAINING STRONTIUM. (O Radioaktivnoi Zagryaznennosti Ryby pri Obitanii v Vode Soderzhashchei Strontsii.) M. M. Saurov. Translated from Trudy Vsesoyuz. Konf. po Med. Radiol., Voprosy Gigieny i Dozimetrii, 66-73(1957). 14p. $0.50(OTS).

In fish tissue under prolonged contact with water containing radioactive strontium there occurs an intense accumulation of strontium. With this a direct relation has been established between the degree of accumulation of radioactive strontium by tissues, on the one hand, and the activity of the water, the time of accumulation, and the contents of calcium in the tissues, on the other. The intensity of accumulation is inversely related to the concentration of the calcium in the water. The maximum permissible concentrations of radioactive strontium for water in open reservoirs has been established without allowing for the possibility of its accumulation by water organisms; suitable correction factors are thus necessary. (auth)

19080 JPRS-L-514-N

SANITARY PROTECTION OF OPEN WATER RESERVOIRS FROM CONTAMINATION BY RADIOACTIVE SUBSTANCES. A. N. Marei (Marey). Translated from p.32-90 of "Sanitarnaya Okhrana Otkrytykh Vodoyemov ot Zagryazneniya Radioaktivnymi Veshchestvami," Gos. Izd. Vo Med. Lit-Ref., Moscow, 1958. 70p. $1.75 (OTS).

When a water source is contaminated by long-lived radioelements, they will most probably invade the organism by way of the water it drinks. Consistent systematic consumption of water containing activities in excess of the maximum permissible concentration creates the danger of their accumulation inside the organism, which may cause a radiation injury. Another path of the infiltration of radioelements into human organisms is the consumption of contaminated food. Data are summarized on the biological effect of radioactive substances. Methods of sanitary and health physics control of the purity of open water reservoirs, underground supply sources, and other sources of water supply, drainage systems, and water-conveying facilities are discussed. Methods of decontaminating liquid wastes containing radioactive substances are reviewed. Instruments for radiometric assays are described. (C.H.)

19081

A GRANULAR COLLECTOR FOR SAMPLING FALLOUT DEBRIS FROM NUCLEAR DETONATIONS. E. M. Romney, J. W. Neel, G. M. Le Roy, A. J. Steen, and K. H. Larson (Univ. of California, Los Angeles). Am. Ind. Hyg. Assoc. J. 20, 267-73(1959) Aug.

A granular collector for sampling fall-out debris from nuclear detonations was developed which consists of a shallow, metal tray and a removable mylar plastic liner filled with ⅛-inch diameter polyethylene plastic pellets. Fall-out debris impinging upon the exposed collector tray during fall-out is physically entrapped within the granular matrix and later separated from the matrix by wet sieving in isopropyl alcohol. The fall-out debris may be fractionated into different particle size ranges by dry sieving with standard testing sieves. An operational procedure for recovering the primary fall-out debris from the granular matrix is described. The efficiency of the recovery procedure was tested using pre-sized glass beads, soil samples and fall-out debris. Virtually all particulate material smaller than the granular matrix could be removed by wet sieving in isopropyl alcohol. Less than two per cent of the sample was lost during a dry sieving process of fractionating the particulate material into 13 different particle size ranges. A recovery of more than 95 per cent of the samples processed through the operational procedure was consistently obtained. The granular fall-out collector was used extensively during the 1957 Weapons Testing Series in areas adjacent to the Nevada Test Site. It compared favorably with the gummed paper and was superior to resin-coated tray collectors and soil surface samples as a means of collecting fall-out; it was superior to all of these collectors with respect to the ease of separation of primary fall-out particles for physical and chemical characterization and for bioassays. The granular collector is economical for widespread coverage of anticipated fall-out areas. (auth)

19082

THE DETERMINATION OF ZIRCONIUM IN AIR. Evan E. Campbell (Los Alamos Scientific Lab., N. Mex.). Am. Ind. Hyg. Assoc. J. 20, 281-3(1959) Aug.

A procedure is described for the analysis of air samples for zirconium. Calorimetric measurements of zirconium were made after isolation from air. (C.H.)

19083

ADMINISTRATIVE EXPERIENCE WITH OCCUPATIONAL OVEREXPOSURE TO RADIATION. Morris Kleinfeld and A. P. Abrahams (New York Dept. of Labor, New York). Am. Ind. Hyg. Assoc. J. 20, 294-8(1959) Aug.

Nineteen instances of radiation overexposure in excess of the limits prescribed by Industrial Code Rule 38 have been reported to the New York State Department of Labor since December, 1955. In eight instances, the reported excessive readings were found to be invalid and may be ascribed, on the whole, to faulty dosimetry technique. There were eleven instances of actual overexposure; four were chronic in nature, four were acute external overexposures, and three were acute internal overexposures. The acute overexposures resulted from accidents; the chronic overexposures were associated with routine everyday operations. Ten employees showed positive biological effects such as radiation burns and/or abnormal retention of radioactive material. Injury to the hands was the effect most frequently observed among the chronically as well as the acutely exposed. These accounted for seven of the ten reported instances. The causal factors most frequently involved in the overexposures were lack of supervision, lack of awareness of the hazard, and failure to provide or maintain appropriate protective devices. In general, the data indicate that the incidence of radiation overexposure (1.4 per cent) and injury (0.3 per cent) in New York State is extremely low when compared to other major industrial hazards. (auth)

19084

EVALUATION OF FALLOUT DATA. Alan A. Jarrett (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Am. Ind. Hyg. Assoc. J. 20, 299-302(1959) Aug.

A rapid method is presented for identifying and dating a nuclear detonation by a graphical transformation which adjusts mixed fission product decay data to linear form. Applications of the method are discussed for monitoring the air in the vicinity of a laboratory where contamination of the air from radioactive gases is a possibility. (C.H.)

19085

A VENTURI SCRUBBER INSTALLATION FOR THE REMOVAL OF FISSION PRODUCTS FROM AIR. H. S. Jordan and C. G. Welty (Los Alamos Scientific Lab., N. Mex.). Am. Ind. Hyg. Assoc. J. 20, 332-6(1959) Aug.

A local exhaust collection system and a venturi scrubber installation for the cleaning of exhaust air contaminated with acid mists and mixed fission products are described in detail. It was determined that 20 cfm exhausted by a local slot exhaust hood would control the maximum evolution of gases from a 1500 ml beaker. Features of the exhaust system that were designed to offset the hazard of perchloric acid condensation in the system included welded stainless steel construction, sloping horizontal runs, regulating valves only on vertical sections, and adaptability to cleaning by simple washdown. The feasibility of a venturi scrubber with a caustic solution as the scrubbing medium for low loadings of iodine vapors (2.4×10^{-4} to 7.3×10^{-3} $\mu g/m^3$) was indicated by an average removal efficiency of 95 per cent. Air-cleaning efficiencies for acid mists were dependent on the type of acid suspended in the air stream. Removal efficiencies of 90 per cent and 95 per cent were obtained with nitric acid and oxides of nitrogen loadings of 2 grams/m^3, and with perchloric acid loadings of 3 grams/m^3, respectively. Total fission product loadings ranging from 0.01 to 0.4 mc/m^3 were removed from the contaminated air with an average efficiency of 94 per cent. (auth)

19086

RADIATION HAZARDS. Clinton C. Powell. Amer. J. Public Health 49, 1-9(1959) Jan.

As peaceful uses of radiation sources have expanded and rapid strides made in diagnostic roentgenology, larger numbers of individuals have become exposed to radiation hazards. Probability of benefit and potential harm must be carefully evaluated in the specific circumstances involved. Distinction is made between acute radiation effects from nuclear warfare or remotely potential major reactor incidents and the more subtle delayed effects of day to day exposure to low levels of radiation. Delayed biological damage of concern relates to genetic effects, neoplasms, and life span shortening. While the exact magnitude of exposure which will produce damage may in some instances be controversial, it seems prudent to assume in practice that no threshold exists. Useful x ray examinations should not be abandoned but radiation exposure should be kept as low as feasible. Use of radiation in the healing arts accounts for the largest amount of exposure of the population to

man-made sources. Reduction of radiation exposure in the healing arts can be accomplished by limitation of the size of the primary beam through coning or diaphragming, filtration to absorb soft radiation, improved technic in radiographic examination, and use of optimum technical factors related to kilovoltage, films, developers, etc. 23 references. (auth)

19087

THE PREPARATION OF INTERNATIONAL RADIATION PROTECTION RECOMMENDATIONS BY THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION (ICRP). R. G. Jaeger. Atomkernenergie 4, 261-7(1959) July-Aug. (In German)

A brief history of the International Commission on Radiological Protection is presented. The basic values of the maximum permissible doses and the latest ideas on maximum permissible dose for internal radiation are discussed and explained. (J.S.R.)

19088

THE THERAPY OF ACUTE RADIATION SICKNESS, A PROBLEM FOR BASIC RADIOLOGICAL RESEARCH. H. Langendorff. Atomkernenergie 4, 267-70(1959) July-Aug. (In German)

The successful treatment of acute radiation sickness requires procedures for which there is, as yet, insufficient basic information. The experimental results of radiologists in this field are briefly reviewed. It is shown that animals exposed to very high doses of radiation can be treated with transplantation of normal bone marrow or spleen. Especially good results can be obtained when genetically identical donor cells are used for the transplantation. 39 references. (tr-auth)

19089

PROCESSES OF THE PROPAGATION OF RADIOACTIVE PARTICLES AND THE INHALATION OF RADIOACTIVE AEROSOLS. W. Herbst (Universität, Freiburg i. B.). Atomkernenergie 4, 300-5(1959) July-Aug. (In German)

Autoradiographic observations of sedimentations of radioactive fall-out particles on foils during the second half of 1958 in Freiburg/Breisgau and Grafenhausen/Black Forest are reported and discussed. Less than 5% of the particles had an autographic life of more than 6 months. Less than 2% of the particles had radioactivities of more than 10^{-4} μc. No general correlations were found between the number of the particles and the total radioactivity, precipitation, and geographic altitude. During the years 1957/59 in 3 survey places in Essen, the ratio of the filterable to the nonfilterable radioactivity of the precipitations was found to be about 1:2. The deposition of radioactive particles on plant material and their passage through the GI-tract of animals were proved autoradiographically. Woods and parks were suitable places to capture partly radioactive particles transported by the atmosphere. Observations of the physiological processes during the absorption of radioactive-labeled aerosols by the lungs together with the GI-tract's participation are reported. The related radiobiological problems are discussed. (auth)

19090

OBSERVATIONS ON THE SEDIMENTATION OF RADIOACTIVE PARTICLES IN DUISBURG IN THE YEAR 1958. W. Altvater and W. Herbst (Universität, Freiburg i. B.). Atomkernenergie 4, 306-7(1959) July-Aug. (In German)

Sedimentations of radioactive particles, transported in connection with the fallout-model, were observed in 1958 in 2 places in Duisburg with the aid of autoradiographic films from capture-foils. From 1 to 2% of the particles had radioactivities of about 10^{-4} μc and more, generally with a short lifetime. There was no general correlation between the number of particles and the total radioactivity or quantity of precipitation. (auth)

19091

ANALYSIS OF THE t^{-1} CURVE OF ARTIFICIAL RADIOACTIVE FALL-OUT. T. Franke (Universität, Munich). Atomkernenergie 4, 308-12(1959) July-Aug. (In German)

From the temporal course of the activity of a mixture of fission products, from explosions which have occurred at different times, formulas are derived for the calculation of the following data: the intervals in time between the single explosions and the yields on total activity of the fission-products from the single explosions. Furthermore the several characteristic forms of decay curves which result from such mixtures are discussed. The influence of radioactive decay series among the fission-products on the total activity is studied. For practical work with the formulas given there is needed a great accuracy of measurements. (auth)

19092

THE PREPARATION OF THE NEW RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION FOR RADIOLOGICAL PROTECTION (ICRP) ON EXISTING RADIATION PROTECTION MEASURES. J. Zakovsky (Universität, Vienna; Technische Hochschule, Vienna; and Ph. T. Prüfanstalt fur Radiologie und Elektromedizin der Stadt, Vienna). Atomkernenergie 4, 322-7(1959) July-Aug. (In German)

The differences between the recommendations which have been valid up to now and those agreed upon in 1958 are shown. Then follows a discussion of the effects of the new rules for the individual in which persons are to be protected against radiation exposure. Suggestions to what extent alterations of the existing measures should be necessary are made. (auth)

19093

PRINCIPLES OF THE CONSTRUCTION OF APPARATUS FOR RADIOACTIVITY MONITORING AND DETAILS OF THE NETWORK OF THE GERMAN WEATHER SERVICE. Max Hinzpeter. Beitr. Physik Atmosphäre 30, 207-10 (1958). (In German)

According to federal law the Deutscher Wetterdienst is charged with the monitoring of the atmosphere with regard to radioactive pollution. The monitoring network comprises 10 stations which measure the specific beta activity of the air near the surface and of the precipitation. Gamma radiation is registered when the activity exceeds a certain value. The aerosols carrying the artificial activity of the air near the surface are deposited on a celulose filter after the air has gone through a compressor. The activity is recorded by a counter- and impulse frequency system. The activity of precipitation is measured by a vaporization procedure. To monitor the gamma activity the stations have an ionization chamber which activates a signal at a certain value of the discharge by ionizing radiation. Details of the measuring procedures and of the applied instruments are described. (auth)

19094

AIR POLLUTION AND SOIL IRRADIATION CAUSED BY THE STACK RELEASE OF A REACTOR IN NORMAL OPERATION. C. Jehanno. Bull inform. sci. et tech. (Paris) No. 30, 2-13(1959) June. (In French)

The amounts of argon-41 released by the stack of the EL-3 reactor and the resulting increases in gamma radiation at the soil level are determined. The methods used are described. The argon-41 concentration in the stack air is proportional to the reactor power and reaches 3×10^{-4} cm³ at 2 Mw. If the air output of the stack is 20,000 m³/hr or 5.55 m³/sec, the stack releases 1.7×10^{-3} c of argon-41/sec when the reactor is operating at 2 Mw. The highest gamma activities of the soil caused by argon-41 outside the center were measured during a temperature inversion and were approximately 80 μr/hr. The total irradiation during a year was determined for a point 500 m from the stack. (tr-auth)

19095

ACTIVITY OF THE ATMOSPHERE CAUSED BY KRYPTON-85. G. Delibrias and C. Jehanno. Bull inform. sci. et tech. (Paris) No. 30, 14-15(1959) June. (In French)

Krypton-85, a beta emitting gas with a period of 10.4 years, is injected into the atmosphere during nuclear explosion and treatment of irradiated fuel elements. The air activity from Kr^{85} was measured with a krypton-filled proportional counter. The activity reached 1.9×10^{-12} c/m³ of air during July 1958. An increase of the order of 3.5 was found between 1954 and 1958. (tr-auth)

19096

ARTIFICIAL RADIOACTIVITY IN THE STRATOSPHERE. C. Jehanno and J. Labeyrie. Bull inform. sci. et tech. (Paris) No. 30, 16-19(1959) June. (In French)

A measurement of the air concentration of beta-active dust particles of artificial origin was made up to 12,000 m altitude in the Parisian region on the morning of November 20, 1958. The average concentration of beta emitters carried by the dust was 220 times higher per unit weight of air than the concentration measured in the soil the same day. (tr-auth)

19097

MODIFICATION OF THE NATURAL RADIOACTIVITY CAUSED BY CARBON-14. C. Léger, M. T. Perquis, and G. Delibrias. Bull inform. sci. et tech. (Paris) No. 30, 20-2(1959) June. (In French)

The natural radioactivity of carbon, from carbon-14, has varied, first, because of the industrial era and, second, because of the atomic era. The increase of the specific activity of carbon, caused by atomic explosions, is about 13‰ and appears to be growing exponentially. The activity measurements were made on atmospheric carbon dioxide and the carbon of leaves and animal blood. (tr-auth)

19098

MEASUREMENT OF THE γ RADIATION OF THE HUMAN BODY. MEASUREMENT OF NATURAL RADIOACTIVITY. DETECTION AND MEASUREMENT OF RADIOACTIVE CONTAMINATION. A. Blanc, A. Lansiart, and L. Jeanmaire. Bull inform. sci. et tech. (Paris) No. 30, 23-34(1959) June. (In French)

The difficulties in the measurement of the radioactivity of the human body are examined. The apparatus used for the measurements is described. It consists, principally, of a 5-cm thick lead enclosure and a lead collimator surrounding a NaI(Tl) crystal 20 cm in diameter and 10 cm high. An amplitude selector with 25 channels is used. Some measurement results on normal individuals and individuals exposed to internal contamination are reported. The instrument can also be used to study contamination of animals, vegetables, and foods. Some results of such measurements are given. (J.S.R.)

19099

PHILOSOPHY AND PRACTICE OF RADIOACTIVE WASTE DISPOSAL. R. B. Temple. Commonwealth Eng. 46, 76-8(1958) Nov. 5.

The views of the Australian Atomic Energy Commission regarding radioactive waste disposal are presented. (auth)

19100

ON THE TOXICITY OF BERYLLIUM. V. V. Mel'nikov. Farmakol. i Toksikol. 21, 73-7(1958) June.

It was found that the smallest dosage of beryllium oxide dispersions inducing death in rats, when injected subcutaneously, was 10 mg/kg of weight. The toxicity of beryllium oxide, under these conditions, approached that of beryllium chloride, beryllium nitrate, and beryllium oxifluoride, i.e., the soluble compounds. The toxicities of various subcutaneously or intravenously injected beryllium compounds are tabulated. When inhaled, beryllium acetate is lethal to white rats at a concentration of 30 mg/m³ of air. It is concluded that the toxicity of insoluble beryllium salts, including the oxide, greatly increases with the degree of dispersion. (auth)

19101

RADIOACTIVITY IN SURFACE WATER. H. P. Kramer, D. W. Moeller, and D. A. Pecsok. J. Am. Water Works Assoc. 50, 1516-22(1958) Nov.

The principal sources of radioactive materials in water include natural radioactivity, by-products from uranium ore and reactor operations, reactor by-products, and weapons tests. Four figures are presented showing examples of maximum permissible concentrations for certain radionuclides in surface waters and the range of radioactivity attributable to fallout, a forecast of nuclear reactor capacities to be installed during the next several decades and the wastes to be expected therefrom, the growth in the number of radionuclide shipments and their distribution over the past 11 years, the number of nuclear bombs detonated throughout the world since 1945 and the resulting deposition of Sr^{90} as recorded in Pittsburgh and New York since 1953. (auth)

19102

PRACTICAL RADIATION PROTECTION. Adrian Johnson. Med. J. Australia 1, 38-42(1959) Jan. 10.

The possibility of harmful genetic effects from radiation is discussed. The view is expressed that the contribution to gonad exposure from superficial radiotherapy has probably been overstated. The prudence of taking every precaution to reduce dosage is underlined. The dose measured at the approximate gonad area in the treatment of a series of dermatological patients is listed. Simple and easily applied methods by which this dose can be reduced to low or unmeasurable values are set out. The most important of these are the covering of the table with lead, the use of lead aprons, and the posturing of the patient. The application of these measures by physicians carrying out diagnostic procedures, with accruing protection to their patients and themselves, is pointed out. Mention is made of the value of the routine use of a dosemeter. (auth)

19103

RADIOACTIVE FALL-OUT. C. Auerbach. Nature 183, 1773-6(1959) June 27.

The biological hazards of radiation from radioactive fall-out are discussed. Authoritative statements on hazards from man-made radiation are reviewed. Dosage estimates and genetic consequences are considered. (C.H.)

19104

SAFETY ASPECTS OF WORKING WITH PLUTONIUM. Arthur B. Shuck (Argonne National Lab., Lemont, Ill.). Nuclear Energy Engr. 13, 411-14(1959) Apr.

Hazards of working with plutonium are discussed relative to four properties of the element; it can become critical, it emits alpha particles, it can constitute a radiation hazard, and in certain forms it is pyrophoric. Safe handling methods, storage methods, and fire fighting techniques are discussed. (C.J.G.)

19105

RADIOACTIVITY AND THE DISTRIBUTION OF WATER FROM LAKE CONSTANCE. J. Holluta. Schweiz. Ver. Gas- u. Wasserfach. Monatsbull. 38, 102-7, 127-33 (1958).

After a general discussion of the increasing use of radioactive substances and the causes and effects of radioactive contamination of ground and surface waters, the radioactivity of Lake Constance is considered. The radioactivity of water in the lake near Riet, 40 m below the surface, increased tenfold, from 0.02 to 0.22×10^{-10} c per liter in the period May, 1956 to August, 1957. In most cases, water taken from the lake for public supplies is only disinfected, and the treatment plants are incapable of reducing the radioactivity of the water. Even when the water is filtered, some substances, such as strontium-90, remain almost unchanged. The treatment of radioactive waste waters is also discussed. It is emphasized that any atomic plants to be built in the area should treat their waste waters to reduce the concentration of radioactive substances below the danger level, and provide auxiliary protection for use in the case of accidents. The storage of radioactive wastes in the basin of Lake Constance should be prohibited. (auth)

19106

METEOROLOGICAL PHASES OF AIR POLLUTION PROBLEMS ASSOCIATED WITH THE OPERATION OF THE HANFORD WORKS. Glenn R. Hilst. In "Proceedings [of the] National Conference on Applied Meteorology, Hartford, Conn., October 1957."

The operation and maintenance of a large energy plant, such as the Hanford Works, inevitably entails the problem of atmospheric disposal of radioactive and toxic wastes. The contributions of meteorological knowledge and services to the successful solution of the problem of economical and safe use of the atmosphere for routine disposal of gaseous wastes at Hanford are reviewed. The observational systems and methods for early warning and operational guidance in the case of an untoward large-scale release of contaminants are described and evaluated briefly. (auth)

19107

SOME ASPECTS OF SAFEGUARDING HIGH PRESSURE SYSTEMS IN NUCLEAR TECHNOLOGY. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-32. Russell H. Scott (General Electric Co., Richland, Wash.). New York, Engineers Joint Council, 1959. 25p. $0.50.

The growing uses of pressurized equipment require increased attention to safeguards. Three examples from nuclear research work are cited: a thermal hydraulic test loop, including findings from a pressure vessel rupture incident; a laboratory sublimation experiment involving a pressure-vacuum explosion; and details of protection for a hazardous autoclave system. (auth)

19108

RADIATION AND CONTAMINATION CONTROL AT HANFORD REACTORS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-33. Sterling L. Nelson (General Electric Co., Richland, Wash.). New York, Engineers Joint Council, 1959. 23p. $0.50.

The philosophy and application of radiation hazards control at the Hanford Plutonium Production Reactors are described. Equipment, methods, and procedures used in the control of contamination and radiation are discussed and examples showing specific applications are presented. (auth)

19109

BASES FOR ESTABLISHING NUCLEAR SAFETY CRITERIA. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-35. Norman Ketzlach (General Electric Co., Richland, Wash.). New York, Engineers Joint Council, 1959. 15p. $0.50.

A method of analysis has been presented that may be used to determine nuclear safety of arrays based on mass limitations, mass per unit area limitations for single infinite plane arrays, and mass per unit length for arrays in the form of cylinders (tube bundles of fuel elements). (auth)

19110

THE VALIDITY OF FILM-BADGE AND POCKET-CHAMBER RECORDS IN EVALUATING THE RADIATION EXPOSURE OF PERSONNEL. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-37. Hanson Blatz (New York Univ.). New York, Engineers Joint Council, 1959. 3p. $0.50.

Good personnel monitoring records (either of film or pocket instrument readings) are necessary in order to describe fully the radiation exposure of workers. A review of current practices shows many ways in which the completeness of such records can be improved. It should be possible to reconstruct the dose distribution within a worker's body in order to determine the dose to various critical organs for which dose limits have been established. It is in the best interests of the nuclear industry to be cognizant of medical and dental x-ray requirements and include provisions in dosimetry research and development for these needs which are often more demanding. (auth)

19111

THE AIR POLLUTION BIBLIOGRAPHY. VOLUME II. Arnold J. Jacobius, Jack R. Gibson, Vincent S. Wright, Wave E. Culver, and Ludmilla Kassianoff. Washington, D. C., Library of Congress, 1959. 181p.

This volume contains 800 abstracts selected more or less at random from material published from 1952 to 1958. An author index and a subject index which accumulates the entries of Volumes I and II are given. (C.J.G.)

INSTRUMENTS

19112 AECL-803
Atomic Energy of Canada Ltd., Chalk River, Ont.
PROCEEDINGS OF THE SIXTH TRIPARTITE INSTRUMENTATION CONFERENCE HELD AT CHALK RIVER, ONTARIO, APRIL 20-24, 1959. PART 3: SYSTEM AND COMPONENT RELIABILITY. J. E. Woolston and S. J. Townsend, eds. June 1959. 26p. $1.00(AECL).

Four papers are presented on Harwell electronic equipment, Chalk River instrumentation, and ion chamber reliability. A list of the attendees is given. (W.D.M.)

19113 AECL-803(Paper 3.1)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
RELIABILITY OF ELECTRONIC EQUIPMENT AT HARWELL. K. Kandiah and L. A. Kilbey. Paper 3.1 of PROCEEDINGS OF THE SIXTH TRIPARTITE INSTRUMENTATION CONFERENCE HELD AT CHALK RIVER, ONTARIO, APRIL 20-24, 1959. PART 3: SYSTEM AND COMPONENT RELIABILITY. 3p.

The main points brought out in an analysis of the reliability of instruments and components over the period 1953-56 are summarized. The nuisance value of unreliable equipment from the maintenance point of view is discussed. Some figures on transistor failures are given. (W.D.M.)

19114 AECL-803(Paper 3.2)
Atomic Energy of Canada Ltd., Chalk River, Ont.
A STUDY OF COMPONENT-FAILURE ANALYSIS AND STATISTICS IN RESEARCH EQUIPMENT AT CHALK RIVER SINCE 1956. F. S. Goulding, R. B. Shields, and R. T. Dancer. Paper 3.2 of PROCEEDINGS OF THE SIXTH TRIPARTITE INSTRUMENTATION CONFERENCE HELD AT CHALK RIVER, ONTARIO, APRIL 20-24, 1959. PART 3: SYSTEM AND COMPONENT RELIABILITY. 8p.

Issued separately as CRR-797-3.1.

Data are given which represent the results of a three-year study of component failures in Chalk River electronic equipment. A fault card is made out by the mechanic each time a servicing call is made and these cards, edge-punched in coded form, are sorted in various ways to produce the results given. More than 150 types of instruments used in all parts of the plant were subjected to this treatment. (W.D.M.)

19115 AECL-803(Paper 3.3)
Atomic Energy of Canada Ltd., Chalk River, Ont.
RESULTS OF A STUDY OF RELIABILITY IN REACTOR-CONTROL AND -SAFETY INSTRUMENTS. R. T. Dancer, A. Pearson, R. B. Shields, and E. Wuschke. Paper 3.3 of PROCEEDINGS OF THE SIXTH TRIPARTITE INSTRUMENTATION CONFERENCE HELD AT CHALK RIVER, ONTARIO, APRIL 20-24, 1959. PART 3: SYSTEM AND COMPONENT RELIABILITY. 5p.

Issued separately as CRR-797-3.2.

As the component-fault records were being surveyed it became increasingly clear that there was more to be seen than the simple random failure of components. A closer look is taken at the group of instruments that make up the reactor control and safety systems of NRU and NRX. The NRU fault rate is considerably greater than the NRX rate. (W.D.M.)

19116 AECL-803(Paper 3.4)
Atomic Energy of Canada Ltd., Chalk River, Ont.
LONG-TERM RELIABILITY OF CHALK RIVER ION CHAMBERS IN REACTORS. H. Carmichael. Paper 3.4 of PROCEEDINGS OF THE SIXTH TRIPARTITE INSTRUMENTATION CONFERENCE HELD AT CHALK RIVER, ONTARIO, APRIL 20-24, 1959. PART 3: SYSTEM AND COMPONENT RELIABILITY. 2p.

Issued separately as CRR-797-3.3.

In the latest ion chamber in use at Chalk River, type-TQU, the coating was applied to a magnesium electrode using the U. S. oil suspension of colloidal boron. The resistance of the coating was decreased by centrifuging most of the oil out of the boron suspension and adding colloidal graphite in oil. Twenty of these ion chambers have been operating in the NRU and NRX Reactors for more than a year and only one has shown any change in its saturation characteristics. (W.D.M.)

19117 AECU-4232
Radiochemistry, Inc., Louisville, Ky.
MEDIUM LOW-LEVEL SOFT-BETA COUNTING EQUIPMENT. James E. Lewis. June 15, 1959. 35p. Contract AT(11-1)-530. $6.30(ph), $3.00(mf) OTS.

Developmental studies of a reliable inexpensive scalar, high voltage supply, counter, and counter gas are described. Several organic and inorganic gases were examined for counter properties which permit buzz-bomb packaging and at the same time Geiger characteristics. Results of the study indicate that there is little chance of finding a single Geiger gas suitable for buzz-bomb packaging; however, mixtures of ammonia and argon appear promising as do freons and genetrons. Development work on absolute flow counters for weak beta emitters at medium and low levels of activity was essentially completed. (J.R.D.)

19118 AECU-4249
Los Alamos Scientific Lab., N. Mex.
AN ABSOLUTE MASS RATE FLOWMETER. F. A. Guevara, R. M. Potter, and W. E. Wageman. [1958?]. 9p. Contract [W-7405-eng-36]. $1.80(ph), $1.80(mf) OTS.

A true mass flow rate device has been developed that is absolute in the sense that it requires no calibration. The flow measurement is made by adding a known amount of energy to a gas and finding its resulting temperature increase. The flowmeter is essentially pressure independent and is capable of 0.1% reproducibility. It is suggested that other versions of this flowmeter should be practical over wide ranges of pressure and temperature and should be usable with a variety of gases and liquids. (auth)

19119 AERE-R-2903
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A NANOSECOND TIME TO AMPLITUDE CONVERTER, A.E.R.E. TYPE NO. 2011A. F. H. Wells and A. K. Barlow. June 1959. 19p. $0.42(BIS).

An instrument designed to enable time interval measurements to be made on the range below one microsecond is described. The instrument produces a rectangular output pulse with an amplitude proportional to the time difference between "start" and "stop" input pulses corresponding to the limits of the time interval to be measured. The output pulses are then analyzed by a multichannel pulse amplitude analyzer. (W.D.M.)

19120 AERE-R-2943
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A CURRENT-STABILISED POWER SUPPLY USING

TRANSISTORS. F. M. Russell and D. Orr. June 1959. 10p. $0.35(BIS).

A circuit is described which has been used successfully for stabilizing currents of up to one ampere to better than five parts in 10^5 which employs transistors. Curves are given showing the frequency dependence of the phase-shift and gain of the amplifier stage together with a curve showing the relative stability of the amplifier stage as a function of a particular resistance in the circuit. Precautions necessary for the multiple operation of these units from common power supplies are described and circuit diagrams are given. (auth)

19121 ALI-C-59535

Little (Arthur D.) Inc., Cambridge, Mass.

CENTRIFUGE FOR RADIOCHEMICAL PROCESSING. Sept. 23, 1955. 35p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 587. $6.30(ph), $3.00(mf) OTS.

The feasibility of designing and developing a canned centrifuge capable of operating for extended periods in a highly radioactive area was investigated. A preliminary design for the entire unit is outlined. It is concluded that such apparatus can be designed and built. Cost estimates are given, and recommended features for incorporation in the centrifuge are listed. (J.R.D.)

19122 ARF-1151-1

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

MAGNETIC RECORDER FOR NUCLEAR PULSE APPLICATION. Period Covered: June 5, 1959 to August 5, 1959. G. M. Burgwald. Aug. 12, 1959. 8p. Contract AT(11-1)-702. $1.80(ph), $1.80(mf) OTS.

The advantages of storing nuclear pulse height information on tape for later use with an analyzer are pointed out. Experiments with a magnetic modulator playback head which would offset inaccuracies due to tape speed variation are described. (T.R.H.)

19123 ARF-1152-1

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

AN IMPROVED NUCLEAR DENSITY GAUGE. [Period covered] June 1 to July 1, 1959. G. M. Burgwald and C. A. Stone. June 8, 1959. 4p. Contract AT(11-1)-745. $1.80(ph), $1.80(mf) OTS.

A principle similar to that of double-beam optical systems is utilized. The source used is thulium-170. (C.J.G.)

19124 CCC-454-TR-311

Callery Chemical Co., Penna.

A LOW TEMPERATURE ADIABATIC CALORIMETER WITH AUTOMATIC SHIELD CONTROL. W. J. Cooper, R. H. Forsyth, J. F. Masi, and R. E. Pabst—S. L. Harvey, ed. May 22, 1959. 21p. Project ZIP. Contract NOa(s) 58-454-d.

The design and operation of an adiabatic, low-temperature calorimeter employing an automatic shield control of unique design are described. Thermocouple difference is sensed by a d-c microvolt amplifier, which is followed in the circuit by a recorder-controller and a Leeds and Northrup Series 60 (current adjusting type) control unit. The output of the latter is used to control the voltage across the shield heaters through a Westinghouse "Magamp" saturable reactor. This design has been used successfully with a conventional low-temperature adiabatic calorimeter (50 ml sample size). In most cases the recorder showed no variation from zero (± 0.002°) during heating and equilibrating periods, while the momentary disturbance at "on" and "off" was less than 0.05°K. Results are reported for an n-heptane standard sample over the range from 55 to 365°K. (auth)

19125 GAT-L-431

Goodyear Atomic Corp., Portsmouth, Ohio.

RING GASKET PUNCH GUIDE. K. B. Booth. Dec. 10, 1957. 2p. Contract AT-(33-2)-1. $1.80(ph), $1.80 (mf) OTS.

The ring gasket punch guide can be made in two pieces or as a single piece. The two-piece design is more advantageous because a large number of guides can be obtained by different combinations of interchangeable parts. A gasket is produced by cutting a center hole with a punch; the smaller step is inserted into the hole, thus positioning the larger step so that it can be used to guide the punch in cutting the outside diameter of the gasket. (W.L.H.)

19126 HW-60320

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CRITICAL INCIDENT ALARM—MODEL I: INSTRUCTION AND MAINTENANCE MANUAL. P. R. Kelly. May 8, 1959. 14p. $3.80(ph), $2.40(mf) OTS.

The HAPO Critical Incident Alarm, Model I, is an instrument designed to give an audible and visual alarm signal in the event of a critical incident to which it is exposed. The instrument is self-contained, including the radiation detector, and is calibrated to alarm at 500 mr/hr in a gamma field. The system consists of a sodium iodide crystal, photomultiplier tube, meter, magnetic amplifier relay, power relay, alarms (siren and light), and power supply. (W.D.M.)

19127 IDO-16510

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

TIME OF FLIGHT CORRECTION FOR DETECTOR THICKNESS IN THE MTR FAST CHOPPER TIME ANALYZER. B. G. Nelson. July 10, 1959. 19p. Contract AT(10-1)-205. $0.50(OTS).

In order to increase the probability of detecting the neutrons from the MTR fast chopper, five detector banks have been placed together along the neutron flight path. An automatic time correction is desirable for this arrangement to correct the nominal time of arrival of neutrons in any of these detector banks to a time corresponding to one point in the flight path. This corrects for the transit time of the neutrons across the five detector banks. Continuously varying corrections are necessary since the correction for a given counter spacing changes as a function of the flight time. This system consists of one fixed and four variable delay channels, each channel corresponding to one of the detector banks. Each variable delay channel produces a linearly changing voltage with time. A light pulse from the fast chopper initiates a voltage sweep in a reference channel, and an ionization pulse from the neutron detector bank in which the neutron is detected initiates the voltage sweep in the corresponding variable delayed channel. When the reference voltage and the delayed voltage are equal a time-corrected pulse is generated corresponding to the time of arrival of the fixed channel. This pulse is then stored in the appropriate time channel of the 1024 channel time analyzer as if all of the detector banks were at the same point in the flight path. The resolution of the five bank ten inch detector was reduced to that of the single bank two inch detector. This is an improvement by a factor

of 3.5 at one electron volt which allows one per cent resolution. (auth)

19128 IGO-R/W-26

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

A REMOTE HANDLING MANIPULATOR FOR CHEMICAL ANALYSIS. A. J. Howarth. Apr. 19, 1956. 27p. (IGC-ARDC/P-191).

A new approach to remote handling for chemical analytical purposes is described, which provides a cheap alternative to the American masterslave manipulator. Intended primarily for use in the Dounreay high-activity laboratories, it supplies most of the services required by the analyst, by an over the wall technique, while still permitting the fitting of a shield roof over the cubicle. Activities of up to 80 curies may be handled. (auth)

19129 NR/P-2/59

United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England.

ELECTRONIC EQUIPMENT FOR FAST NEUTRON TIME-OF-FLIGHT MEASUREMENTS. R. J. Brooker, W. G. Gore, and C. H. Vincent. Aug. 1959. 40p.

This report describes electronic equipment used at AWRE for neutron time-of-flight work. This equipment was used on the fast neutron time-of-flight spectrometer for the 6-Mev Van de Graaff generator, and it has also been used for other fast neutron time-of-flight work at AWRE. (auth)

19130 NRL-5305

Naval Research Lab., Washington, D. C.

A REMOTELY OPERATED CHARPY TEST MACHINE FOR RADIOACTIVE SPECIMENS. J. R. Hawthorne and L. E. Steele. Mar. 12, 1959. 10p.

Apparatus for the remote testing of standard Charpy V-notch specimens was developed for the NRL Metallurgy Division Hot-Cell Facility. Specimens of various steels for atomic-energy applications are tested in this facility after irradiation in materials testing reactors. With this apparatus, test temperatures within the range of −100° to 300°F can be attained. Heating and cooling are accomplished remotely by gas flow, thus eliminating the need for liquid temperature-control baths. Specimen temperature is measured continuously during the heating or cooling cycle by means of a thermocouple in contact with the specimen. Placement of the irradiated specimen in the test machine is accomplished automatically by pneumatic devices controlled by a synchronous programmer. With this system, approximately five seconds are required to test a specimen after it has been conditioned thermally. (auth)

19131 ORNL-2671

Oak Ridge National Lab., Tenn.

AN ELECTRONIC, HIGH-RESOLUTION, X-RAY IMAGING SYSTEM. J. W. Allen and R. W. McClung. Aug. 11, 1959. 20p. Contract W-7405-eng-26. $4.80(ph), $2.70 (mf) OTS.

The need for an electronic-imaging system for high-resolution radiography is discussed with regard to economy and amenability to mechanized processes. An experimental system consisting of an x-ray sensitive Vidicon in a conventional closed-circuit television system is presented as a potential solution to the problem. The operational characteristics of the x-ray sensitive Vidicon, which employs selenium as the photoconductive sensing element, are discussed and data are presented which describes its contrast sensitivity and picture quality. The applicability of this system to practical inspection problems, including its amenability to continuous scanning techniques, is discussed. Recommendations for future improvements of this inspection method are made. (auth)

19132 PA-TR-2564

Picatinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

DEVELOPMENT OF A NUCLEAR TIMER FOR SATELLITE APPLICATION. Martin Lazarus and Chester L. Smith. Sept. 1958. 17p.

A nuclear timer was developed to produce a time delay in the range of 45 to 60 minutes. This unit, which incorporates a self-contained power supply, is capable of reliably firing a pyroswitch or detonator at the termination of the delay period. It can be initiated remotely by means of a low-energy pulse and can be continuously tested without ill effect before application is made. This device provides a delay interval which is reproducible within ±1% and holds this tolerance under adverse environmental conditions. (auth)

19133 RDB(W)/TN-42

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

THE USE OF AN ELECTROSTATIC PRECIPITATOR AND THE DESIGN AND CONSTRUCTION OF THE ASSOCIATED POWER UNIT FOR AIRBORNE DUST SAMPLING. P. Burnett. Oct. 29, 1952. 18p.

Equipment developed to collect airborne alpha-active dust in a form suitable for alpha-energy measurements in an ionization chamber is described. The modification and use of a standard electrostatic precipitator are described, together with the design and construction of a high-voltage power unit capable of supplying 12 kilovolts at 6 milliamperes. Typical performance figures for the whole equipment are included. The efficiency of collection of activity on the sampling foil ranges from 40 to 80% at the highest airflow rate normally used, i.e., about 100 cubic meters per hour. (auth)

19134 SCR-89

Sandia Corp., Albuquerque, N. Mex.

MICROBAROGRAPH INSTRUMENTATION. H. E. Hansen. June 1959. 17p. Contract [AT(29-1)-789]. $0.50(OTS).

Presented at IRE SEVENTH REGION CONFERENCE, Albuquerque, N. Mex., May 1959.

Microbarographs are used at the Nevada test site to measure acoustic energy at certain locations with respect to blasts. These data are used then to decide if weather conditions are favorable for a nuclear test. The microbarograph and its operation are described in detail. (T.R.H.)

19135 SCS-R-178

Gt. Brit. Springfields Works, Springfields, Lancs, England.

AUTOMATIC OPERATION OF SPECTROGRAPHS. PART I. D. Morse, J. Shaw, and D. J. Swallow. July 18, 1950. 7p.

The automatic operation of the spectrograph has proved satisfactory, and the advantages are greater accuracy in timing and elimination of personal errors. The operator is left free to observe any other variables such as position of the arc and maintenance of correct arc current. The only work for which the device has been used is pyroelectric work. The entire automatic

operation of the instrument for spectrographing samples is under consideration. (J.E.D.)

19136 SCTM-120-59(15)

Sandia Corp., Albuquerque, N. Mex.

FLYING SPOT SCANNER INVESTIGATION. E. J. Bernard and E. L. Checketts. June 25, 1959. 32p. $6.30 (ph), $3.00 (mf) OTS.

An investigation was made of the practical limits of a flying spot scanning system as applied to the storage and retrieval of large volumes of data. First, a theoretical study was made; second, a laboratory model was built and tested; and third, an attempt was made to determine the best possible results obtainable at the present "state of the art." It was concluded that the flying spot scanner would be ideal for many applications, especially where a single slide is to be searched for minute particles. If the scanner is to be applied to data storage and retrieval, further consideration must be given to a number of problems, including the making and handling of slides, speeds and storage of the readout, and the method by which the data are presented to the scanner. (auth)

19137 SCTM-226-59(15)

Sandia Corp., Albuquerque, N. Mex.

RELIABILITY CONSIDERATIONS IN CIRCUIT DESIGN. A. M. Breipohl. July 21, 1959. 21p. $4.80 (ph), $2.70 (mf) OTS.

Several reliability principles which can be applied to circuit design are described. A possible relationship between the design engineer and the reliability engineer is discussed, describing how the special qualifications of the reliability engineer can be of assistance in solving circuit design problems. Short discussions of various reliability methods — signal distribution studies, failure model construction and analyses, and considerations of modes of failure — are amplified by a mathematical development in the Appendix. The use of a "failure model" to select the one circuit having the best reliability characteristics from a number of proposed circuits of varying characteristics is illustrated. A general explanation is also made of how reliability and design considerations can merge to produce more reliable circuits in a shorter time than can be produced by normal design methods alone. (auth)

19138 UCRL-5649

California. Univ., Livermore. Lawrence Radiation Lab.

A LARGE BAKEABLE VACUUM VALVE. Thomas H. Batzer. Aug. 6, 1959. 13p. Contract W-7405-eng-48. $3.30 (ph), $2.40 (mf) OTS.

The development and design of a large bakeable valve based on a unique seat arrangement and a novel motion seal are described. The seat sealing is accomplished through the use of high pressure fluid actuation of an annular pinch gasket. Experimental data on seat closure performance, and the specific design features to achieve successful closures, are presented. The bakeable motion seal utilizes a stainless steel bellows sleeving over an inner concentric actuating shaft. This shaft is bent at 90° to the axis of rotation and is free to rotate relative to the bellows. There is no apparent size limitation to this type of actuation. The design of a 10-inch gate valve utilizing these principles is described. (auth)

19139 WAPD-TH-450

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

TRANSDUCER SYSTEM RESPONSE TESTS. R. Masnovi. [Oct. 1958]. 26p. $4.80 (ph), $2.70 (mf) OTS.

Results are presented from tests which were made to determine the lag times and response characteristics of various bare transducer and transducer-capillary tubing systems by subjecting these systems to a step decrease in pressure. For most of the tests, one side of the transducer was pressurized to its maximum range while the other side had similar tubing and fluid and was open to the atmosphere. (W.D.M.)

19140 DSI-tr-394

THE MASS-SPECTROMETER AS AN INSTRUMENT FOR CHECKING INDUSTRIAL PROCESSES. V. L. Tal'roze Translated from Sessiya po Nauchnym Problemam Avtomatizatsii Proizvodstvo 3, 145-67. AUTOMATIC GAS ANALYSERS OF THE MASS-SPECTROMETER TYPE. N. N. Shumilovskii (Shumilovsky) and R. I. Stakhovskii (Stakhovsky). Ibid. 168-86. 21p.

The problems relating to the assembly and use of mass spectrometers as instruments for checking and automatic regulation of industrial processes are discussed. The range of substances which can be analyzed by the mass-spectrometric method includes practically all the substances included in the raw materials and products of the oil and chemical industries. The advantages and disadvantages possessed by automatic gas analyzers of the mass spectrometer type are given. An analog computing device for determining composition of multicomponent mixtures to be checked is discussed. (C.J.G.)

19141 IGRL-T/R-66

THE DEVELOPMENT OF PUMPED STORAGE IN THE GERMAN GRID SYSTEM. K. Bohler. Translated by B. Rigby and H. W. Curtis (U.K.A.E.A., Risley) from Elektrizitätswirtschaft 56, 341-6; 385-9 (1957). 23p.

After considering the present development of pumped storage in three stages, the author deals with the origins and advantages of pumped storage stations. The second part contains several examples of how the storage stations are organized in Germany and a discussion of the special problems connected with their building and management. (auth)

19142 NP-tr-273

A NEW PRESSURE GAGE FOR LOW PRESSURES, PARTICULARLY PRESSURES BETWEEN 10^{-3} AND 10^{-6} MILLIMETERS. F. M. Penning. Translated by A. Palme from Physica 4, 71 (1937). 8p. Available from General Electric Co. (Report TR 25291), Schenectady, N. Y. (KZ-2086).

A brief discussion of the design, use, and advantages of a manometer for indicating the pressures of condensing vapors is presented. (J.E.D.)

19143

A β-RAY SPECTROMETER OF TOROID-SECTOR TYPE. A. Szalay and D. Berényi (Hungarian Academy of Sciences, Debrecen, Hungary). Acta Phys. Acad. Sci. Hung. 10, 57-77 (1959).

A β ray spectrometer has been constructed with sector pole pieces of shaped boundary and 42 air gaps arranged in a toroidal form. By using all the gaps the optimal resolution was ~3%, while the maximum of the used solid angle was ~ 2.5%. In the case of a sufficiently strong source, however, one or just a few gaps may be used, and in this way with a suitable adjustment of the baffles, even 0.7% resolution was obtainable. The apparatus was calibrated by standard conversion

lines and several well-known β ray spectra also were taken for control purposes. The slight current consumption and other special advantages of the toroid sector type spectrometer are discussed. (auth)

19144

A SIMPLE SINGLE-CHANNEL ANALYZER FOR MEDICAL MEASUREMENTS. F. Hawliczek (Krankenhause der Stadt, Vienna-Lainz). Atomkernenergie 4, 328-31 (1959) July-Aug. (In German)

An improved single channel analyzer for medical measurements in connection with a normal scintillation counter is described. The electronics are simplified in comparison with a gamma-ray spectrometer. This is possible because for medical measurements resolution and stability need not be so high as for single channel analyzers used for gamma-ray spectrometry. (auth)

19145

DETECTOR FOR SLOW NEUTRONS. Miroslav Vorisek (Inst. of Nuclear Physics, Prague). Chechoslov. J. Phys. 7, 757-66(1957). (Translated from Referat. Zhur. Fiz. No. 11, 1958, Abstract No. 24543.)

A scintillation counter is proposed for slow neutrons. The counter is obtained by sintering ZnS (Ag) and B_2O_3. The experimentally-obtained optimum value of the ratio ZnS (Ag)/B, which is approximately equal to 9:1, makes it possible to obtain a scintillator of large dimensions with a thickness from 0.75 to 1 mm with sufficiently high efficiency with respect to registration of thermal neutrons (25%). The detector can operate with a strong background of gamma rays because of its different sensitivity to gamma rays (from 10^{-4} to 10^{-8}%) and thermal neutrons (from 10 to 5% respectively). The counter has a resolution on the order of 10^{-7} seconds and a sufficiently good stability. (auth)

19146

BALLOON-BORNE CIRCUITS SORT HIGH-ALTITUDE COSMIC RAYS. Donald Enemark (State Univ. of Iowa, Iowa City). Electronics 32, No. 35, 52-5(1959) Aug. 28.

Design and discussion of the cosmic ray measuring system are presented. Using inexpensive germanium transistors, the circuit measures cosmic ray energy and intensity. The system has been found to operate effectively at a temperature range of −45 to 38°C and at altitudes of 130,000 ft. A telemeter coding system is designed for reception through noise. (C.J.G.)

19147

CONTROL EQUIPMENT OF A MAGNET FOR MEASURING NUCLEAR MAGNETIC RESONANCE. Pál Feit. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 21-38(1957) Jan.-Feb. (In Hungarian)

The current supplying the magnet for measuring nuclear magnetic resonance is regulated by an electronic stabilizer. The potential at the two control points of the stabilizer is supplied from batteries, one for each point, divided by potentiometers. The remote controlled gear for operating the potentiometer and experiences with its actual use are described. Dimensions of the electromagnetic shaft coupling gear are specified. Finally, a new design for a gear, made on the basis of the experiences with the one already in use, is considered. (auth)

19148

A MAGNETRON UNIT. József Lehöcz and János Pálinkás. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 43-9(1957) Jan.-Feb. (In Hungarian)

The construction and operation of a magnetron supply unit with hard tubes, having a frequency of 3000 Mc/s and a maximum output of 200 kw pulses, for the feed of a microwave resonance accelerator are described. (auth)

19149

CONTROL EQUIPMENT OF A MAGNETRON UNIT. János Pálinkás. Magyar Tudományos Akad. Kozponti Fiz. Kutató Intézetének Közleményei 5, 50-6(1957) Jan.-Feb. (In Hungarian)

The relay system of the magnetron supply unit is described. The system insures steady operation, remote control, and protection against erroneous coupling as well as breakdowns. (auth)

19150

EFFECT OF MAGNETIC STRAY FIELD ON THE PLACE OF IMAGE IN SPECTROMETERS. István Berkes. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 106-13(1957) Jan.-Feb.

For sectorial magnetic fields the image is displaced from its geometrically calculated place on account of fringing fields. The lateral displacement is calculated. In actual measurements this is compensated for by altering the field intensity. The correction of the field intensity to be applied was proved by experiments. (auth)

19151

A SIMPLE DOUBLE-PULSE GENERATOR. Lóránd Horváth and Andras Neszmélyi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 248-52(1957) Mar.-Apr. (In Hungarian)

A pulse generator is described which delivers negative double pulses in one or two channels with a maximum amplitude of 40 v. The length and the spacing of the double pulses can be independently adjusted in the time interval 0.5 to 100 μsec and 0 to 100 μsec. (auth)

19152

THE WORK FUNCTION OF CATHODES FOR ELECTRONS AND THE PERFORMANCE CHARACTERISTICS OF GEIGER-MÜLLER COUNTING TUBES. Ottó Orient. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 379-89(1957) May-June. (In Hungarian)

The influence of the work function of G-M counting tube cathodes upon the performance characteristics of the tubes is investigated. The cathode materials investigated are Zn, Cd, Cu, and Ni. The results show that for counting tubes of identical geometry and filled to the same pressure, the plateau is longer and its slope lower for tubes with cathodes characterized by larger work function. For identical overvoltages the electric charge liberated per count was proved to be the same in counting tubes with different cathodes. It follows that other things being equal, the number of ions per discharge is independent of the material of the cathode. (auth)

19153

A 600 kV RADIOFREQUENCY CASCADE GENERATOR AND HOMOGENEOUS FIELD ACCELERATOR. Gábor Kálmán and László Varga. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 402-13 (1957) July-Aug. (In Hungarian)

The 600 kv radiofrequency cascade generator and the accessory homogeneous field accelerator of the Department of Atomic Physics are described. The heating is made by means of 230 kc RF power. The ion source energy is supplied at radiofrequencies. (auth)

19154
A FAST OPERATING BISTABLE MULTIVIBRATOR. Nándor Szabó. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 442-4(1957) July-Aug. (In Hungarian)

To increase the resolving power above 4 MHz by a new dimensioning of the attenuators of fast bistable multivibrators, a new design principle and a corresponding example are shown. (auth)

19155
1 MW DELAY LINE PULSE MODULATOR FOR MAGNETRON FEEDING. József Lehöcz. Magyar Tudományos Akad. Központi Fiz. Kutató Intéznetének Közleményei 5, 483-92(1957) Sept.-Oct. (In Hungarian)

Operation and construction of a pulser, generating pulses of 1 Mw energy and 1 μ sec width and using a delay-line and a double spark gap for driving a pulsed magnetron, is described. (auth)

19156
IGNITION CIRCUIT OF A SPARK GAP SWITCH. János Pálinkás. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 493-4(1957) Sept.-Oct. (In Hungarian)

An electronic apparatus of 50 Hz repetition frequency and 15 to 20 kv voltage, producing ignition pulses of a few μsec and controlling the switch of a spark gap magnetron supply unit, is described. (auth

19157
ON THE DESIGN OF A DELAY LINE AND ITS CALIBRATION BY DELAYED COINCIDENCE MEASUREMENTS. László Lakosi and József [Mráz] Zimányi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 502-13(1957) Sept.-Oct. (In Hungarian)

The parameters of a variable delay line type for the 10^{-7} sec region are considered. Electronic and nuclear measurements carried out to check the results obtained are described. (auth)

19158
FIRST EXPERIENCE OF A NEW APPARATUS FOR "AUTO-SCANNING." L. Baschieri (Università, Rome). Minerva nucleare 3, 139-42(1959) May. (In Italian)

A new and original set up is presented, which permits the normal diagnostic use of radioisotopes and at the same time a systematic scanning of rectangular areas from 10 to 70 cm long and 10 to 50 cm across. The autoscanning system is a direct recorder. The counter may be moved on horizontal or curvilinear surfaces parallel to the body section under investigation. The latter characteristic is particularly interesting for the investigation of thyroid gland. The first results on a thyroid phantom of paraffin are presented. A facility is also present for connection of the counter to a ratemeter and pen recorder in order to explore the activity distribution in legs or arms. For this purpose, which is particularly important for searching for secondaries of thyroid carcinoma, the counter is moved only along the longitudinal axis. (auth)

19159
A STUDY OF CAVITY ION CHAMBERS FOR USE WITH 2 mV X-RAYS: EQUILIBRIUM WALL THICKNESS: WALL-ABSORPTION CORRECTION. G. P. Barnard, E. J. Axton, and A. R. S. Marsh. Phys. in Med. Biol. 3, 366-94(1959) Apr.

The difficulties associated with the determination of the equilibrium wall thickness and the associated wall-absorption correction in a cavity ion chamber to be used with radiation of a particular quantum energy are discussed in some detail. It does not appear possible to devise any experiment to measure directly the γ ray or x ray absorption in the wall of the chamber. An analytical study has been made of total ionization versus wall-thickness curves from which the required wall-absorption correction is derived. It appears that electronic equilibrium is not fully achieved in the N.P.L. graphite cavity chambers; but since the wall-absorption correction at present applied is too large, partial compensation for lack of electronic equilibrium is fortuitously achieved. As a by-product of this analysis, a new method of deriving the relationship between total ionization and atomic number of wall material has been developed for a single chamber. It is suggested that this merits further experimental study with monoenergetic sources. (auth)

19160
X RAY EQUIPMENT. (REVIEW). M. M. Umanskii (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 3, 3-17(1959) May-June. (In Russian)

A review is given of x-ray equipment used in various fields of research and industry. X-ray detectors are described. Diffraction procedures, microscopy, and various methods of material testing and analysis are discussed. 66 references. (R.V.J.)

19161
ON THE POSSIBILITY ON REDUCING ABERRATION COEFFICIENTS IN ANALYZERS WITH HETEROGENEOUS FIELDS. M. I. Korsunskii and V. V. Zashkvara (Khar'kov Polytechnic Inst.). Pribory i Tekh. Ekspt. No. 3, 21-5(1959) May-June. (In Russian)

The ion-optical properties of multisector electrostatic analyzers are studied. It is shown that by selecting fields in different sectors, it is possible to derive a zero congruence of the principal aberration coefficients at high dispersion. (tr-auth)

19162
NEUTRON SPECTROMETER WITH FLAT CRYSTALS. Yu. Ya. Konakhovich and I. S. Panasyuk. Pribory i Tekh. Ekspt. No. 3, 26-31(1959) May-June. (In Russian)

A neutron spectrometer with a flat crystal, erected on a uranium–graphite RPT reactor, is described. The spectrometer showed a flux of monochromatic, 0.1 ev neutrons of 5.3×10^5 neutrons/cm^2-min, with a background ratio of incoherent scattering equal to 130. The spectrometer is operated by remote control. The total effective cross sections of Pu^{240} and Au measured with the spectrometer as well as the neutron spectra of the reactor at 7.96 Mev are shown as examples of the spectrometer efficiency. (tr-auth)

19163
MEASUREMENTS OF ELECTRON AND γ-QUANTUM ENERGIES WITH LOW EFFICIENCY COUNTER. Yu. D. Prokoshkin and T'ang Hsiao-Wei (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Pribory i Tekh. Ekspt. No. 3, 32-4(1959) May-June. (In Russian)

A method is described for determining electron and γ energies by measuring the number of shower electrons formed in lead. The number of shower electrons are measured with low-efficiency halogen counters. (tr-auth)

19164
CORONA COUNTERS FOR STRONGLY IONIZING PAR-

TICLES. A. B. Dmitriev, Yu. M. Tolchenov, A. I. Filatov, and V. G. Chaikovskii. Pribory i Tekh Ekspt. No. 3, 35-40(1959) May-June. (In Russian)

Descriptions are given of counters performing under conditions of stable corona discharge and designed for recording strongly ionizing particles. The pulse amplitude is proportional to ionization created by the particle. The amplifier coefficient is up to 10 to 10^3 and is independent of source intensity. The counters have an extensive, slightly sloping plateau. A strong background of weakly ionizing radiation does not affect the counter parameters in relation to strongly ionizing particles. Descriptions are included on the mechanism of the counter operation. (tr-auth)

19165

THE SHAPE OF CORONA COUNTER ELECTRIC FIELD. Yu. M. Tolchenov. Pribory i Tekh. Ekspt. No. 3, 40-3(1959) May-June. (In Russian)

The electric field shape was calculated for strongly ionizing particle counters operating in a stable corona discharge. The results were verified by measuring the time of the ion transitions through the counters and correlating these magnitudes with calculated data. The theoretical and experimental data are in good agreement. (tr-auth)

19166

MULTIWIRE CHARGED PARTICLE COUNTERS. A. S. Deineko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). Pribory i Tekh. Ekspt. No. 3, 44-6(1959) May-June. (In Russian)

A double-ring, multiwire counter was developed and tested. The counting efficiency was 2.8 for β particles of maximum energy 1.3 Mev. The counter can be used in experiments with solid or gaseous targets. The positron yields from $B^{10}(d,n)C^{11}$ and $C^{12}(p,\gamma)N^{13}$ were measured in order to test counting efficiency. (tr-auth)

19167

DOSIMETRY CHARACTERISTICS OF LOW-VOLTAGE HALOGEN COUNTERS. A. B. Dmitriev, D. I. Peskov, A. B. Kheifets, and V. G. Chaikovskii. Pribory i Tekh. Ekspt. No. 3, 47-9(1959) May-June. (In Russian)

Measurements were made of low-voltage halogen counter dosimetry characteristics (the counting rate relation to radiation dose). The maximum counting rates for various recording counters and their resolving times were estimated. The relationship between the dosimetric characteristics and loading resistance is determined. (tr-auth)

19168

SCINTILLATION GAS-DISCHARGE COUNTER. L. S. Sorokin. Pribory i Tekh. Ekspt. No. 3, 57-8(1959) May-June. (In Russian)

Applications of a complex photocathode (antimony–cesium) in a self-quenched counter were studied. The performance of the antimony–cesium photocathode with a small retarding electric field at the surface, used for removing the thermoelectron flux from the cathode and the positive ion flux on the photocathode, was analyzed. In recording Co^{60} γ quanta, the recording efficiency was found to be up to 14.5 times higher than that of the standard BS-4 counter. (tr-auth)

19169

DESIGN OF BORON IONIZATION CHAMBERS. A. B. Dmitriev, M. G. Vorob'ev, L. G. Kosmarskaya, and N. I. Chipurenko. Pribory i Tekh. Ekspt. No. 3, 59-62(1959) May-June. (In Russian)

Boron ionization chambers designed for operation in reactor control systems are described. (tr-auth)

19170

THE GEOMETRY FACTOR FOR CYLINDRICAL IONIZATION CHAMBER. E. E. Kovalev and V. I. Popov. Pribory i Tekh. Ekspt. No. 3, 63-6(1959) May-June. (In Russian)

Geometry factors are considered in γ radiation dosimetry with cylindrical chambers whose linear dimensions are correlated with the distance from the chamber center to the point source. A general expression was derived for the geometry correction factor for a source placed at an arbitrary radial distance from the center of the chamber. Graphs of the geometry correction factor are plotted. The values are used for determining the true ionization density and for determining the optimum shape of ionization chambers. (tr-auth)

19171

RECORDING DEVICE FOR 128 CHANNEL IONIZATION CHAMBERS. N. N. Goryunov (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 3, 84-9(1959) May-June. (In Russian)

Descriptions are given of a 128-channel amplitude recording device designed for operation with ionization chambers. Each channel has a large pulse recording dynamic amplitude range (amplitudes can vary from each other up to 8000 fold). The recording of amplitudes is accomplished by photographing pulses on a cathode ray tube. With the aid of a commutation device it is possible to record 64 pulses simultaneously on one tube screen. (tr-auth)

19172

AN AUTOMATIC DEVICE FOR A SINGLE-CHANNEL SCINTILLATION γ SPECTROMETER. A. N. Pisarevskii and L. D. Soshin (Radium Inst., Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 3, 90-3 (1959) May-June. (In Russian)

A device is described for automatically measuring and recording differential spectra. There are 127 possible points on the spectrum when using only fourteen exact resistances in the divider chain. The time for counting each point set is from 15 sec to 5 min. The scheme does not include step by step selectors or other complicated switching arrangements. (tr-auth)

19173

AN ADAPTER TO SF-4 SPECTROPHOTOMETER FOR MEASURING LUMINESCENCE SPECTRA. A. P. Kilimov, L. L. Nagornaya, and B. A. Zadorozhnyĭ (Khar'kov Research Inst. of Chemical Reagents). Pribory i Tekh. Ekspt. No. 3, 105-7(1959) May-June. (In Russian)

A design is given for a simple photoelectric adapter to SF-4 spectrophotometers for measuring luminescence in solids and liquids. Methods for determining the spectral sensitivity of the device and for measuring the spectra are described. Measurements on phenanthrene, tetraphenylbutadiene, and naphthalene are in good agreement with published data. (tr-auth)

19174

A PISTON MANOMETER OPERATING AT 2000 atm. M. K. Zhokhovskiĭ, Yu. S. Konyaev, and V. G. Levchenko (Lab. of Super-High Compression Physics, Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 3, 118-22(1959) May-June. (In Russian)

Descriptions are given of the design and performance

of a piston-type manometer for operation up to 2000 atm. (R.V.J.)

19175

PHYSICAL METHOD FOR DEVELOPING TRACK PICTURES OF LOW IONIZING PARTICLES. Ya. M. Veprik, S. P. Protsanova, and G. P. Faerman (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Pribory i Tekh. Ekspt. No. 3, 128-9(1959) May-June. (In Russian)

Development of 15-Mev proton and 300-Mev π^+ meson tracks in 200 μ layers of NIKFI-R emulsion with n-oxyphenylglycerin physical developer was studied. It is shown that with the physical developing method it is possible to regulate the size of silver granules in the track and to improve discrimination of proton tracks from the γ background. (tr-auth)

19176

DESIGN OF HODOSCOPE SYSTEM GK-7. I. P. Karabekov, V. V. Avakyan, and N. A. Nalbandyan (Inst. of Physics, Academy of Sciences, Armenian S.S.R.). Pribory i Tekh. Ekspt. No. 3, 130-2(1959) May-June. (In Russian)

Experiments were carried out with a GK-7 hodoscope in order to adapt it for use with a magnetic spectrometer. An analysis is made of the cell specifications and the factors limiting the GK-7 to operations with low-pulse Geiger-Mueller counters. The effects of magnetic fields on the hodoscope performance are also analyzed. (tr-auth)

19177

HALL EFFECT MAGNETOMETER. D. P. Vasilevskaya and Yu. N. Denisov (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Pribory i Tekh. Ekspt. No. 3, 144-5 (1959) May-June. (In Russian)

A device for measuring constant magnetic field intensities at 100 to 17,500 erg with $\pm 1\%$ precision is described. The device is based on the Hall effect in n-type germanium. The crystal dimensions are $2 \times 1.5 \times 0.7$ mm. (tr-auth)

19178

HIGH-SPEED AMPLITUDE ANALYZER. A. A. Sanin, Yang Yen-Ming, Jang Jih-Chang, Vang Ching-Chin, Hsia Sung-Chiang, Tai Kuei-Liang, and Chiang-fu. Pribory i Tekh. Ekspt. No. 3, 156(1959) May-June. (In Russian)

A 100-channel amplitude analyzer was designed with a ferrite memory device and a resolving power of ~ 20 μsec. The detailed description will be given later. (R.V.J.)

19179

MODIFICATION OF THE FARMER ELECTROMETER FOR USE WITH SIEVERT IONIZATION CHAMBERS. Richard Thomason (Univ. of Chicago). Radiation Research 11, 253-4(1959) Aug.

Modifications are described in the Farmer electrometer for use with Sievert ionization chambers. These modifications insure satisfactory performance of the chambers for in vivo studies of radiation absorption. (C.H.)

19180

DETECTION OF ION BEAMS BY ELECTRON MULTIPLIERS IN MASS SPECTROMETRY AND NUCLEAR PHYSICS. A. I. Akishin. Soviet Phys.-Uspekhi 1, 113-23(1959) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13 as Abstract No. 4683.

19181

DIFFUSION CLOUD CHAMBERS. V. K. Lyapidevskii. Soviet Phys.-Uspekhi 1, 124-36(1958) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13 as Abstract No. 4682.

19182

SEMICONDUCTORS IN NUCLEAR PHYSICS AND ENGINEERING. Dimitrje Tjapkin (Belgrade Univ.). Tehnika (Belgrade) 13, (1958). (Translated from Referat. Zhur. Fiz. No. 11, 1958, Abstract No. 25500.)

Radiation defects in semiconductors and their use as dosimeters and radiation-energy converters were investigated. (auth)

19183

APPLICATION OF REACTOR CONTROL TO A-C MOTORS. H. A. Zollinger (Westinghouse Electric Corp., East Pittsburgh, Penna.). Westinghouse Engr. 19, 156-60(1959) Sept.

Various reactor control schemes which give rise to completely static control can be applied to large wound-rotor and squirrel-cage motors. Many different starting and running requirements can also be satisfied. (C.J.G.)

19184

A DETECTOR FOR FAST NEUTRONS. Wolfgang Ball and Karl Heinz Lauterjung (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. angew. Phys. 11, 245-7(1959) July. (In German)

A detector for neutrons with energy greater than 1 Mev is described. The neutrons were detected by recoil protons released in paraffin which were measured in a silver-activated ZnS luminescent screen. In order to obtain the most favorable thickness of the luminescent material for the detection of fast protons up to 11 Mev, the pulse-height distribution of the recoil protons of a Po–Be source of known intensity was measured for various thicknesses of the ZnS(Ag) layer. The investigation showed that a thickness of 15 mg/cm^2 had the greatest proton detection sensitivity and for this layer all other processes gave only a relatively small perturbation background. (tr-auth)

19185

PROCEEDINGS OF THE 1959 BIANNUAL NATIONAL NUCLEAR INSTRUMENTATION SYMPOSIUM, IDAHO FALLS, IDAHO, JUNE 24, 25, 26, 1959. ISA Vol. 2, 1959. Pittsburgh, Instrument Society of America, 1959. 121p. $8.50.

Sixteen papers are presented with abstracts prepared for each. (C.J.G.)

19186

A TRANSISTORIZED TRIP UNIT FOR REACTOR SAFETY SYSTEMS. William A. Power and John A. Dever (Minneapolis-Honeywell Regulator Co., Philadelphia). p.1-7 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

Reliability and high order of fail-safety are achieved in a new device for reactor high-level shutdown. The design uses silicon transistors in a continuously oscillator-tested amplifier with an input current differential of two microamperes. The trip point is stable with temperature and highly immune to line voltage

disturbance. Units with self-contained metering, checking circuits and chamber supply can be combined in a compact system with isolated voltage or relay output for magnet control. (auth)

19187

POWER RANGE FLUX AMPLIFIER. Harry H. Hendon, Jr. (General Electric Co., San Jose, Calif.) and David D. Akers (General Electric Co., Palo Alto, Calif.). p.9-12 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

A power range flux amplifier was developed utilizing solid-state components with the exception of the input electrometer tube. An automatic tester is used which verifies operability of the instrument by superimposing a pulse of current on the input signal once per second and requiring that trip output be produced by each test pulse. Upon failure of an instrument, a spare, similarly tested, may be automatically substituted for the defective unit. (auth)

19188

DIGITAL POWER-CALCULATOR FOR A NUCLEAR REACTOR. Stanley M. Hearne (Convair, Fort Worth, Tex.). p.13-18 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

A digital power-calculator is described which, using the principle that thermal power into a coolant system is proportional to the product of coolant flow rate and the temperature rise of the coolant across the system, automatically measures instantaneous power level and displays this information in digital form. A horizontal in-line 4-digit number, displayed in digital form every two seconds, indicating instantaneous power level, is obtained by accumulating for a period of one second 100 kc pulses occurring in groups, proportional in number of pulses per group to the temperature difference and the number of groups per second proportional to flow rate. By this process of summation a product indicating instantaneous power level is obtained. (auth)

19189

REACTOR EFFLUENT RADIATION MONITORING. R. J. Leuba and J. C. Veburg (Tracerlab, Inc., Richmond, Calif.). p.19-27 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

The monitoring of gaseous and liquid wastes from reactor and processing plant sites requires a wide variety of sampling, detection, and information-processing equipment. Some of the design factors involved in the selection and construction of instrumentation for waste monitoring are discussed. (auth)

19190

AUTOMATION IN A GENERAL PURPOSE NUCLEAR COUNTING ROOM. D. G. Egan (Convair, Fort Worth, Tex.). p.29-37 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

The Nuclear Aircraft Research Facility automatic counting room system provides computed dose measurements from irradiated samples with a practical minimum of manual handling. The major portion of the equipment used in former manual counting channels has been incorporated in the automatic channels. Raw data from the counting room proper is reduced by a digital computer using a program designed as a part of the over-all system. (auth)

19191

A SEMI-AUTOMATIC PLATEAU PLOTTER. C. D. Geilker (Robert A. Taft Sanitary Engineering Center, Cincinnati). p.39-47 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

An instrument has been devised to run plateaus on Geiger-Mueller and internal proportional laboratory counters. It was assembled from standard commercially available equipment and enables the operator to determine ten or fifteen plateaus per hour. The plateau is plotted on a six-inch strip chart recorder and this record is attached directly to the laboratory instrument for reference during counting operations. By the use of this simple and rapid method of plateau plotting, the effects of several variables (e.g., source diameter, energy of the emission, alpha-beta-gamma mixtures, etc.) upon counter performance were examined. (auth)

19192

OPTIMIZING THE RATIO OF TIME CONSTANT TO RADIATION LEVEL FOR PRECISION COUNT-RATE METERS. R. A. McLean and A. H. Fowler (Union Carbide Nuclear Co., Oak Ridge, Tenn.). p.49-54 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

When both accuracy and speed of response are required in the measurement of radiation level, a knowledge of the factors determining scatter is essential. A simple method of expressing the accuracy in terms of the integrating time and radiation level is developed. (auth)

19193

A TRANSISTORIZED 128-CHANNEL ANALYZER AND SCALER. Robert E. Beam (Northwestern Univ., Evanston, Ill.) and Perry L. Toback (Radiation Counter Labs., Inc., Skokie, Ill.). p.55-63 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

A new and versatile type of nuclear instrument is described. In addition to being a 128-channel pulse-height analyzer, it is a scaler which is suitable for preset-time and preset count gross counting. As an analyzer, 127 of its channels are used for data accumulation and the remaining channel is used as a preset time control channel; as a scaler, 125 of its channels may be used for count data storage for the preset-time mode of operation or for clock-pulse time storage for the preset-count mode of operation. The first channel is also used as the control channel for the gross counting modes of operation. The control channel functions on a binary basis; the remaining 127 channels, on a decimal basis. The control channel has a binary storage capacity of 2^{32}; each ordinary channel a decimal storage capacity of 10^8. Count data may be displayed in the form of arabic decimal numbers or in curve form. (auth)

19194

A FOIL ACTIVATIONS ANALOG COMPUTER. L. A. Turner, J. T. Bracken, and R. L. Shipp. p.65-8 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

Foil activation is frequently used in nuclear dosimetry as a means of accurately measuring neutron flux. A number of nuclear reactions, having different thresholds, may be used to obtain an approximation of flux and energy distribution. Unfortunately, the half lives of many of the radioisotopes formed may not be long in comparison with the time of exposure, and if, in addition, the radiation level is not constant, a tedious mathematical problem may result. An analog computer has been designed and constructed to solve

this type of problem from data recorded on magnetic tape. (auth)

19195

IMPROVED ALPHA SPECTROSCOPY USING A MODIFIED FRISCH GRID IONIZATION CHAMBER AND A 256 CHANNEL ANALYZER. T. B. Crockett and T. T. McMillan (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.69-76 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

The technique of utilizing an ionization chamber with a pulse-height analyzer to analyze alpha-emitting isotopes has been developed with good resolution and stability. The resolution obtained from an electroplated Po^{210} source was 0.72% (38 kev width at half maximum). Low specific activity samples were electroplated and counted for hours with similar results. Electronic modifications to a Tracerlab Frisch Grid ionization chamber and preamp, utilizing a 256 channel analyzer for pulse analysis, with good electrodeposition methods made this possible. The leading edge of the voltage pulse from the ionization chamber was made linear by two electronic changes and the resulting pulse analyzed by a Radiation Counter Laboratories 256 channel analyzer. (auth)

19196

TRANSISTOR 1024 CHANNEL TIME-OF-FLIGHT ANALYZER. Frank Petree (Phillips Petroleum Co., Idaho Falls, Idaho). p.81-4 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

The MTR time-of-flight analyzer sorts pulses according to neutron scattering angle and time of flight. Up to 16 angles can be used and up to 1024 time channels. The measured input dead time for counting loss calculations is 2.7 microseconds. The storage time per pulse is 25 microseconds. The time channels are determined by a crystal oscillator which has no time jitter with respect to the master timing pulse, and has negligible frequency drift. The magnetic memory matrix uses only 48 drive transistors to directly pulse the cores in 1024 channels of a magnetic memory core matrix, without the use of transformers. The data are punched into IBM cards in quaternary form and processed by an IBM-650 computer. (auth)

19197

AN INSTRUMENTATION AND CONTROL SYSTEM FOR RADIOACTIVE FLUID PROCESSES. D. S. Toomb (Oak Ridge National Lab., Tenn.). p.85-94 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

An instrument system designed for reliable control of radioactive fluid processes is described. The system consists of weld or ring-joint sealed primary elements, electric transmission from differential-transformer primary-element motion sensors, electropneumatic transducers, conventional pneumatic record-indication-alarm and control elements, and metal-bellows-actuated control valves. The advantages and disadvantages of this system are discussed, and the state of development of the newer components is described. (auth)

19198

WIDE RANGE GAMMA-NEUTRON MONITOR. R. L. Schuch, D. L. Williams, and F. N. Hayes (Los Alamos Scientific Lab., N. Mex.). p.95-8 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

A two-probe liquid scintillation system with a dynamic range of 3×10^8 is described, measuring radiation rates from 3×10^{-5} to 10^4 rads/min. The instrument is particularly suited for radiation monitoring in the vicinity of nuclear reactors and for field applications where the source is some distance from the recording station. (auth)

19199

COMPENSATED ION CHAMBERS. E. B. Hubbard (General Electric Co., West Lynn, Mass.). p.99-106 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

Gamma-compensated neutron-sensitive ion chambers are subject to shifts in degree of compensation. Causes of these shifts and corrective steps necessary to minimize them are analyzed. (auth)

19200

THE DIFFERENTIAL TRANSFORMER IN HIGH TEMPERATURE NUCLEAR RADIATION ENVIRONMENTS. R. L. Moore (Oak Ridge National Lab., Tenn.). p.107-17 in "Proceedings of the 1959 Biannual National Nuclear Instrumentation Symposium."

The inherent suitability of differential transformers for use as primary sensing elements in high-temperature and nuclear radiation environments is discussed. Design and application considerations for differential transformers in this service are discussed and a design for a high-temperature radiation-resistant differential transformer is presented. (auth)

19201

A LOW COST NUCLEAR POWER PLANT SIMULATOR. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-18. Clyde C. Scott and E. Bjorn Dahlin (Minneapolis-Honeywell Regulator Co., Philadelphia). New York, Engineers Joint Council, 1959. 21p. $0.50.

The construction of a Nuclear Power Plant Simulator for educational use is described. Its application for various reactor types is discussed, and experimental records for a pressurized water reactor are demonstrated. (auth)

19202

CASCADE GENERATORS. E. Baldinger. p.1-63 of "Handbuch der Physik. Band XLIV. Instrumentelle Hilfsmitel der Kernphysik I." (Encyclopedia of Physics. Volume XLIV. Nuclear Instrumentation I.). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 480p.

A detailed survey of the properties of cascade generators is presented. A mathematical treatment of a simple cascade circuit is given, and its general characteristics are explained. In the theoretical discussion rectifiers with condenser input, with very large condensers, and with choke coil input are considered. These considerations lead to a discussion of a typical cascade circuit in its details and to an indication of voltage drop in loaded cascade generators and the mathematical treatment of this voltage drop in good approximation. Production of high voltages with the use of tube oscillators is then described. 86 references. (J.S.R.)

ISOTOPES—INDUSTRIAL TECHNOLOGY

19203 NAA-SR-3260

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRELIMINARY DESIGN STUDY FOR A SODIUM-GRAPHITE-REACTOR IRRADIATION FACILITY. D. S. Thompson and V. Benaroya. Jan. 31, 1959. 105p. Contract AT-11-1-GEN-8. $2.50(OTS).

The results of an investigation to integrate a Na^{24} irradiation processing facility with an operating sodium graphite reactor are presented. An irradiation facility incorporated into a reference SGR (Hallam Nuclear Power Facility, Hallam, Nebraska) is described. Development of the facility application, preliminary design criteria, and capital and operating costs are discussed. Recommendations for further development of the technology and economics of this type of irradiation facility are included. (auth)

19204 CEA-tr-R-683

ETUDE DE L'INTERACTION DE L'ÉMAIL AVEC LA MASSE CÉRAMIQUE À L'AIDE DE RADIOISOTOPES. (Radioisotopic Study of the Interaction of the Enamel with the Ceramic Mass.) G. P. Filintsev and E. I. Morozov. Translated into French by Paulucci and R. de Trezvinsky from Steklo i Keram. 15, No. 5, 34-5 (1958). 7p.

A study was made to determine the depth of penetration in the ceramic body during firing of radioisotopes of Fe^{59} and Ca^{45} deposited before the firing on the ceramic surface in the form of oxide. The investigations were made with porcelain, earthenware, and semi-porcelain samples. Suspensions were prepared of the finely ground oxides and placed on the surface of the polished samples. The samples were carefully dried to insure a uniform distribution of the oxide. The samples were fired, and the depth of penetration was determined by polishing thin parallel beds of the samples and measuring the activity of the exposed layers. The results are tabulated and show that the Fe penetrates deeper in the porcelain than the Ca, but the reverse is true for earthenware and semi-porcelain. Porcelain had the greatest penetration depth and earthenware the least. (J.S.R.)

19205

METHOD OF MANUFACTURING CLOSED THALLIUM-204 PREPARATIONS BY ELECTROLYTIC SEPARATION. Günther Vormum, Dieter Sarrach, and Jürgen Röcker (Deutschen Akademie der Wissenschaften, Berlin). Chem. Tech. (Berlin) 11, 379-81(1959) July. (In German)

The separation of Tl^{204} from reactor-irradiated Tl and its incorporation in a container are described. The Tl is deposited from a glycolic solution of the formate on a copper disk. The apparatus and procedure for preparing the electrolyte and for the electrolysis are described. The procedure for encapsulating the source in a container suitable for use in a radiometric thickness gage is described. (T.R.H.)

19206

UPON THE POSSIBLITY OF USING RADIOACTIVE ISOTOPES IN WOOD INDUSTRY. P. Obloja. Ind. lemnului celulozei si hîrtei 7, No. 2, 57-65(1958). (Translated from Referat. Zhur. Khim. No. 18, 1958, Abstract No. 62365.)

The application of radioactive isotopes to the determination of thickness and weight of various wood materials, of wood moisture, and to the acceleration of the sizing process, etc., was studied. Observations of the movement of various substances (water, fungicides, dyes) in wood, the control of finishing uniformity of the outside surface of materials, various chemical analyses, and the determination of wear of wooden articles were carried out using tracers. (auth)

METALLURGY AND CERAMICS

19207 AECU-4188

Linde Co., Newark, N. J.

WELD PENETRATION TESTS—ZIRCALOY-2 MATERIALS. E. F. Gorman and R. J. Nelson. July 11, 1958. 56p. For Westinghouse Electric Corp. $9.30(ph), $3.60(mf) OTS.

The development of the weld penetration test and its use to evaluate the weld penetration characteristics of various heats of Zircaloy-2 are presented. (W.L.H.)

19208 AECU-4299

Utah. Univ., Salt Lake City. Inst. of Metals and Explosives Research.

ADSORPTION OF SILICIC ACID ON THORIA-DETERMINED BY INFRARED SPECTROSCOPY. Technical Report No. V. Gustaaf J. Spaepen, R. Ted. Wimber, and Milton E. Wadsworth. June 30, 1959. 38p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1075. $6.30(ph), $3.00(mf) OTS.

Adsorption isotherms were obtained for silicic acid adsorbed on thoria from aqueous solutions at 16, 49.6, and 71.5° C. Typical Langmuir isotherms were obtained from which the equilibrium constants could be calculated. Additional equilibrium constants were obtained by equilibrating in an autoclave from which flash samples were removed up to temperatures of 280°C. The amount of silica adsorbed was determined from infrared spectra of the adsorbate on the surface of the thoria. It was found that the silicic acid adsorbed with a positive enthalpy and entropy of adsorption. The equilibrium constant for adsorption increased with temperature to a maximum and then decreased above 215°C. The abnormal positive enthalpy and large positive entropy have been explained in terms of the adsorption of a silicic acid polymer on the surface of thoria involving the breakup of polymer chains and the splitting-out of water from the surface of thoria. At elevated temperatures the length of the polymer chain breaks down, thereby causing the equilibrium constant to go through a maximum and then diminish. (auth)

19209 AECU-4303

[Los Alamos Scientific Lab., N. Mex.]

BONDING URANIUM CARBIDE TO TANTALUM. Melvin G. Bowman. May 19, 1959. 2p. $1.80(ph), $1.80(mf) OTS.

A technique, based on observations made on uranium carbide, tantalum carbide, and tantalum–uranium carbide systems, was developed which was effective in bonding uranium carbide to tantalum metal. (J.E.D.)

19210 AERE-M/R-1811

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE $\gamma \rightarrow \alpha$ TRANSFORMATION IN URANIUM ALLOYS. J. W. Christian. Nov. 24, 1955. 14p.

Using the parameters of pure uranium at room temperature, a suitable correspondence for the $\gamma \rightarrow \alpha$ transformation is chosen and found to be equivalent to that used by Lieberman, Wechsler, and Read in their treatment of the gold–cadmium transformation. The method of these workers is used to predict the crystallographic variables of the transformation. For one solution, a typical variant of the unit vector normal to the habit plane is n = [0.5935, – 0.6312, 0.4995] relative to the cubic γ axes. The direction of the shear in the macroscopic shape deformation is s = [0.4792, 0.7757, 0.5733], and the shear angle is 18.6°. Detailed predictions of the orientation relations for both of the twins assumed to be present in one martensite plate are also made. Another solution gives a typical variant as n = [0.5555, 0.6826, 0.4750] and s = [0.5282, – 0.7308, 0.6015] with the same shear angle. Although the results are self-consistent and allow the habit plane to be an invariant plane of the shape deformation, the large magnitude of the shear angle is thought to make them rather improbable. It is not known how sensitive the calculated quantities are to the assumed parameters; if this is not the explanation, some of the basic assumptions may be wrong. Probably the most incorrect assumption is believed to be that the α plates contain two twin-related regions. (auth)

19211 AFOSR-TN-59-524

California. Univ., Berkeley. Minerals Research Lab.
HIGH TEMPERATURE HEAT CONTENTS OF SOME BINARY IRON ALLOYS. Technical Note No. 2. Weston B. Kendall, Raymond L. Orr, and Ralph Hultgren. July 1, 1959. 16p. Contract AF49(638)-83. (AD-216258).

Representative binary iron alloys were prepared by melting together the pure components in zirconia crucibles under a helium atmosphere in an induction furnace. The melts were subjected to rapid freezing, homogenization at 1350°C under helium, and air cooling. X-ray powder patterns were made to check homogeneity. Chemical composition was determined by checking lattice parameters against published data. High-temperature heat content data are given for Co–Fe, Cr–Fe, Fe–Mn, and Fe–Si. (D.E.B.)

19212 AFOSR-TR-59-88

California. Univ., Berkeley. Minerals Research Lab.
ARC IMAGE FURNACE. Final Report. D. O. Horning. May 1959. 30p. Contract AF18(603)-123.

The design details, optical calibration, and operating conditions of the high-temperature research facility known as the arc image furnace are discussed. Initial operating conditions are given, and some observed data are explained. The basic purpose of this high-temperature research facility is to provide an "uncontaminated" high intensity, heated zone of appreciable size in the temperature range of 6000 to 10,000°K. (auth)

19213 AGARD-216

North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.
SANDWICH STRUCTURE FOR HIGH TEMPERATURE VEHICLES. H. R. Ashley. Oct. 1958. 38p.

Presented at the Eighth Meeting of the Structures and Materials Panel, held October 20-25, 1958, Copenhagen, Denmark.

A review of high temperature sandwich structure from the viewpoints of theoretical structural efficiency and of practical design and manufacturing is presented. Firstly, the boundaries of the review are laid down (150°C to 1000°C in temperature, and both long and short time cycles) and the structural range to which sandwich is applicable is discussed. The physical properties of five materials (R.R.58 light alloy, FV.520 stainless steel, 6 Al 4 Va titanium alloy, Nimonic 90 and 0.5 titanium molybdenum) are summarized and, in conjunction with core data, used to present a series of graphs showing the efficiency of both honeycomb and corrugated sandwich at high temperatures for specific structural index values. Thermal stress factors for these materials at various temperatures are also presented. The remainder of the paper is given to the practical design and production aspects of sandwich construction, and concludes with various types of sandwich that may have applications in conjunction with insulation and cooling systems. (auth)

19214 ANL-4109

Argonne National Lab., Lemont, Ill.
PROPERTIES OF GALLIUM. Summary of Published Data on Alloys, Physical Properties and Chemistry. W. D. Wilkinson. Feb. 10, 1948. 58p. Contract W-31-109-eng-38. $9.30(ph), $3.60(mf) OTS.

Mechanical properties of alloys formed from gallium with various other metals are given. Crystallographic, atomic, spectral, optical, thermal, electrical, magnetic, mechanical, and general properties of gallium are outlined. Chemical properties presented for gallium include general properties, identification reactions, recovery processes, various organic and inorganic reagent and hydrolytic separations, and purification methods. (C.J.G.)

19215 ANL-5837

Argonne National Lab., Lemont, Ill.
QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, AND DECEMBER 1957. 71p. Contract W-31-109-eng-38. $2.00(OTS).

Advanced Water Reactor Program. Investigations have been started on possible urania-ceramic fuels with magnesia, alumina, zirconia, magnesia–zirconia and calcia–zirconia. Mixtures of 45 magnesia–45 zirconia and 9 magnesia–81 zirconia by weight appeared to give good preliminary promise. Work on ThO_2–10 wt.% UO_2 has centered about improvement in density of pellets and elimination of cracking and open porosity. Efforts to increase the percentage of urania in thoria–urania have met with considerable success up to 70 wt.% urania in air-firing tests. Some attempts have been made to prepare UC by reaction of UO_2 with carbon, but so far an incomplete reaction has resulted. As to metal fuels, a sample of U–3 wt.% Ti–1.5 wt.% Nb has shown good corrosion resistance in 345°C water, slightly better than the EBWR fuel alloy. Fast Power Breeder Program. An improvement of the average yield of EBR-II-type fuel pin injection castings has been attained, reaching over 90% as compared with yields of 50 to 60% in the recent past. The uranium-plutonium-fissium alloys proposed for the fuel of EBR-II are being given further examination. The thermal conductivity of U–20 wt.% Pu–10 wt.% Fs alloy was determined at 0.053 (cal/sec-cm-°C) at 600°C and thermal expansion at about $16.7 \cdot 10^{-6}$ per °C in the range 20 to 510°C. Reactor Systems Research and Development. A calibration test of the ultrasonic inspection technique was made on known defect Croloy tubing to check its effectiveness in the examination of fuel jacketing material. Development is continuing on a beta ray method for measuring clad

thickness and on the scintillation counting method of measuring uranium content of fuel plates. An improved design of probe coil for eddy current measurement of cladding thickness has made possible the use of pulse signals instead of the sinusoidal type. Dynamic tests in a new loop are being employed to check the hypothesis that cathodic ions from the loop construction material have been responsible for unusual effects of velocity in the corrosion of aluminum. Corrosion inhibition of magnesium by fluorides is being studied. Specimens of graphite–1 wt.% U_3O_8 fired at 950°C have been made for density and porosity measurements. The bulk density was determined at 1.53 g/cc for a sample with porosity of 21.2 vol.%. Argonne Low Power Reactor. An ultrasonic evaluation of the bond quality of 197 fuel elements for ALPR showed only 8 free of defects. A common defect was edge bond separation. Production, Treatment, and Properties of Materials. Dilatation curves have been obtained for single crystals of uranium in two crystallographic directions, [0 0 1] and [0 1 0]. Compressive tests have been made at 600°C on an uranium single crystal. An analysis made from x-ray back-reflection diagrams shows the slip planes to be {0 2 1} and the slip direction to be quite close to the [$\bar{1}$ 1 2]. Since the {0 2 1} planes have denser packing directions, the reason for the [$\bar{1}$ 1 2] is not clear. The densest direction [1 0 0], being perpendicular to the direction of compression, was inoperative in this test. Results of the investigation of recrystallization of heavily cold rolled alpha uranium sheet have shown that three recrystallized preferred orientations can be obtained, depending on the annealing temperature, whether it is (1) below 360°C, (2) 400°–600°C, or (3) near 650°C. The beta-gamma transformation in high purity uranium has been determined at 774.8 ± 1.6°C. A higher than expected transformation temperature for an uranium-carbon alloy containing 325 ppm C has been attributed to the very low rate of precipitation of small amounts of UC from gamma uranium. Phase diagram work continues on uranium systems with individual fissium elements: Ruthenium, rhodium, ruthenium-molybdenum, and others. Density, thermal expansion and thermal arrest data of 3 to 10 wt.% fissium in uranium have been obtained, with densities ranging from 18.4 down to 17.5 grams/cc, and thermal expansions of the order of 14 microinches per inch per °C. Neutron and x-ray diffraction intensities for UN have been measured and compared with calculated values, which confirm the NaCl-type structure for this material. The fused salt electrolysis cell for the production of high purity plutonium has been completed and a trial run using uranium has been made. A study of a Zr–24 wt.% Pu alloy has shown the existence of a two-phase structure, one of the phases being alpha zirconium. Corrosion work on the titanium-zirconium alloy system is directed at present on explaining the differences in the behavior of these alloys in water and in dry oxygen. The electrical resistance of corrosion films of alloys with increasing ratios of titanium to zirconium has shown a continually decreasing resistivity both in oxygen at 500°C and in water at 350°C. In the determination of solution potentials of aluminum at 100°C, effort has continued on obtaining reproducibility of potential as a function of polarizing current. Alloy Theory and the Nature of Solids. The first phase of the study of the Ti_2 Ni-type phase in zirconium and hafnium has been completed. (For preceding period see ANL-5797.) (auth)

19216 ANL-5904

Argonne National Lab., Lemont, Ill.

AN AUTOMATIC POLISHING MACHINE FOR REMOTE METALLOGRAPHY. F. L. Brown, S. H. Paine, R. J. Fousek, and J. L. Armstrong. Aug. 1959. 19p. Contract W-31-109-eng-38. $0.75(OTS).

Requirements for successful polishing of metallographic specimens are discussed and the design of a machine to accomplish such work on radioactive specimens in a metallographic cave is presented. Quality results, readily obtained by use of the ANL machine, are illustrated by photomicrographs. (auth)

19217 ANL-5935

Argonne National Lab., Lemont, Ill.

A DOUBLE PULSE EDDY CURRENT TESTING SYSTEM. C. J. Renken and R. G. Myers. June 1959. 35p. Contract W-31-109-Eng-38. $1.00(OTS).

The eddy current system, using two pulses of different duration and a new probe design appears to be more versatile than previous eddy current systems developed at Argonne National Laboratory. It is especially useful for the nondestructive measurements of metal electrical conductivity of oddly shaped specimens. These measurements can be made to within one per cent on an absolute basis. The gain stability of this instrument after a thirty minute warm up is better than 0.01%. The main source of drift is the variation of ambient temperature of the air surrounding the probe. Self heating of the probe is negligible. (auth)

19218 ANL-5951

Argonne National Lab., Lemont, Ill.

INSPECTION OF FUEL ELEMENT COMPONENTS AND FUEL ELEMENTS FOR THE ARGONNE LOW POWER REACTOR. W. J. McGonnagle, W. N. Beck, and N. Lapinski. Aug. 1959. 6p. Contract W-31-109-eng-38. $0.50(OTS).

Three nondestructive testing techniques were used in inspecting the ALPR fuel elements and fuel element components: radiography, ultrasonic transmission, and gamma scintillation counting. Radiography was used to inspect the alloy cores, the rolled fuel elements before shearing and the fuel plates after bending. The ultrasonic transmission was used to inspect the alloy cores, the cladding stock and the finished fuel elements. Gamma scintillation counting was used to determine the U-235 content in the fuel element core blanks. (auth)

19219 ANL-6015

Argonne National Lab., Lemont, Ill.

CORROSION OF 1100 ALUMINUM IN BOILING H_2O AND D_2O. J. E. Draley, S. Mori, and R. E. Loess. July 1959. 10p. Contract W-31-109-eng-38. $0.50(OTS).

After an initial exposure period, corrosion rates of 1100 aluminum are approximately the same in H_2O and D_2O at 100°C. More corrosion was observed during the initial exposure period in H_2O, but it is possible that this is only a reflection of the difference in control of the purity of the test water. (auth)

19220 BMI-1355

Battelle Memorial Inst., Columbus, Ohio.

FATIGUE STUDIES OF INCONEL. Raymond G. Carlson. June 26, 1959. 21p. Contract W-7405-eng-92. $0.75(OTS).

As part of a broad program to investigate the complex nature of deformation and fracture in materials stressed at elevated temperature, the fatigue properties of Inconel were studied. Axial-load fully alternat-

ing fatigue tests were performed in the range 1300 to 1500°F, for frequencies of 6 and 60 cpm. Continuous traces of load and strain were made to determine relationships between stress, strain, and lifetime, for lifetimes within the range of 10^3 and 10^5 cycles. The data obtained indicate that fatigue strength, whether measured in stress, total strain, or plastic strain, is a function of both temperature and frequency. It was found that the relationship between stress and strain varies with cycles of stress reversal, never reaching an equilibrium condition. In addition, the strain behavior of a specimen during stress cycling is not continuous. Strain in the plastic region was found to occur in sudden, steplike increments which are predictable functions of temperature, stress, frequency, and cycles. (auth)

19221 BMI-1359

Battelle Memorial Inst., Columbus, Ohio.

THE REACTION OF HYDROGEN WITH ZIRCONIUM-1 AND -25 w/o URANIUM ALLOYS. Harold E. Bigony, R. Robert Doig, Jr., and Horatio H. Krause, Jr. July 6, 1959. 27p. $1.00(OTS).

Hydrogen-absorption isotherms were measured over the range 535 to 835°C for zirconium–1 wt.% and –25 wt.% uranium alloys. X-ray-diffraction studies were made over approximately the same temperature range for the zirconium–1, –25, and –50 wt.% uranium alloys. In general, the alloys resemble the zirconium–hydrogen system, modified by the presence of uranium. With 1 wt.% uranium, the phase boundaries of the zirconium–hydrogen system are shifted to slightly lower hydrogen contents. With 25 wt.% uranium, the first "two-phase" region shifts to a hydrogen content 20 wt.% greater than in the zirconium–hydrogen system, while the second "two-phase" region is unchanged. The eutectoid temperature is increased from 547 to 601°C. Heats of solution of hydrogen in the alloys were found to range from –25.9 to –47.9 kcal per mole for the 1 wt.% alloy, and from –30.7 to –50.6 kcal per mole for the 25 wt.% alloy. The x-ray-diffraction data support the interpretation that, as hydrogen is absorbed, the alloys break down to form uranium and zirconium, and the latter absorbs the hydrogen. The entire ternary isotherms could not be deduced from the data. However, three aspects appear certain: (1) the extent of the phase fields along the zirconium–hydrogen binary at 1 wt.% uranium, (2) the existence of alpha zirconium, alpha uranium, and ZrH_x three-phase fields at low temperatures, and (3) the existence of fields containing beta uranium and ZrH_x at higher temperatures for both the 25 and 50 wt.% alloys. (auth)

19222 BMI-1361

Battelle Memorial Inst., Columbus, Ohio.

CORROSION OF STAINLESS ALLOYS IN HIGH-TEMPERATURE NITROGENOUS ENVIRONMENTS. Donald L. Keller, ed. July 14, 1959. 50p. Contract W-7405-eng-92. $1.50(OTS).

On the basis of screening tests and favorable mechanical properties, AISI Type 318 stainless steel was selected as a fuel-element cladding material to operate in a coolant comprised essentially of gaseous nitrogen modified by the addition of oxygen and water vapor. Tests at atmospheric pressure confirmed calculations which indicated that small additions of oxygen to nitrogen would inhibit nitriding by the process of preferential oxidation. The tests at atmospheric pressure determined that the rate of oxidation of Type 318 stainless was generally at a minimum when 0.5 volume per cent oxygen was added to the nitrogen gas. Oxidation of this steel was more severe when additions of 0.1 and 5.0 volume per cent oxygen were made to the nitrogen. The rate of oxidation was primarily temperature dependent, but was also influenced by time. Oxidation during exposure periods of less than 1000 hr appeared to proceed at a parabolic rate. On longer exposures, however, there were indications of more rapid attack. A maximum depth of attack of 2.9 mils was observed on Type 318 stainless which had been exposed at 1650°F for 3658 hr. Stress-corrosion studies indicated that unstressed and stressed specimens were attacked at about the same rate. Stresses as high as 1800 psi were applied to the stressed specimens. These studies also indicated that the rate of attack increased with an increase in the grain size of the metal and with an increase in the water-vapor content of the gaseous environment. The effect of grain size and water vapor was not as apparent in the studies in which stress corrosion was not a variable. The results of high-pressure studies (200 psi) indicated that, on a qualitative basis, the rate of oxidation was not affected by pressure. (auth)

19223 BMI-1364

Battelle Memorial Inst., Columbus, Ohio.

ELECTRON MICROSCOPICAL EXAMINATION OF BONDS IN ZIRCALOY-2. Arthur P. Young and Charles M. Schwartz. July 29, 1959. 26p. Contract W-7405-eng-92 and NObs-65057. $1.00(OTS).

Electron microscopy was used to supplement metallographic studies of bonds between Zircaloy-2 interfaces. Treated surfaces before bonding, and bonded sections made by a variety of techniques were examined. Electron micrographs of belt-abraded surfaces exhibited a consistent fine-scale roughness. Chemically pickled surfaces were nearly smooth regardless of prior treatment. Chemically pickled samples and a zirconium oxide-coated sample pressure bonded at 1500°F and 10,000 psi had pitting at bond lines that could have been due to voids or to contaminant at the interface which etched out. The pitting was almost completely eliminated in one sample by pressing one hour at 500°F and 350,000 psi. This indicated that the bond-line pitting in these samples was due to voids at the interface. Zircaloy-2 samples pressure bonded after coating with carbon, chromium, iron, nickel, or tin etched in relief along the bond line, indicating the presence of contaminant at the interface. On the basis of the present investigation, it is proposed that grain growth across the interface in chemically pickled samples may have been inhibited by the presence of a thin contaminant film originally present on the Zircaloy surfaces. However, the poor grain-growth characteristics of chemically pickled samples may also be due in part to the surfaces being too smooth. (auth)

19224 BMI-1365

Battelle Memorial Inst., Columbus, Ohio.

DEVELOPMENT OF URANIUM NITRIDE-STAINLESS STEEL DISPERSION FUEL ELEMENTS. Stan J. Paprocki, Donald L. Keller, George W. Cunningham, and Andrew K. Foulds, Jr. July 31, 1959. 22p. Contract W-7405-eng-92. $0.75(OTS).

In research in support of the GCRE, procedures for the fabrication of stainless steel-clad flat-plate fuel elements having a core of 28 w/o UN dispersed in an iron-18 w/o chromium–14 w/o nickel–2.5 w/o molybdenum matrix were developed. The preparation of UN

and its compatibility with the components of the matrix alloy were studied. The UN for the program was prepared by nitriding uranium metal at 850°C and then dissociating the U_2N_3 produced to UN in a vacuum at 1300°C. In compatibility studies, UN reacted with nickel alone at 1800°F, but no reaction with nickel was observed when the other matrix components were also present. The effects of fabricational variables were evaluated by metallographic examination, longitudinal and transverse tensile tests, bend tests, and corrosion tests. Studies indicated that minus 200 plus 325-mesh UN dispersed in a minus 325-mesh elemental-powder matrix rolled green with a 30 per cent initial reduction at 2100°F and then annealed 3 hr at 2300°F produced the best fuel core. (auth)

19225 CF-59-7-35

Oak Ridge National Lab., Tenn.

RUN 300A-8 INITIAL SLURRY RUN OF 300A PUMP AND LOOP. J. C. Moyers. July 2, 1959. 10p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf). OTS.

The 300A pump and loop were operated for 2862 hr with thorium oxide slurry at 1500 psi and 280°C to determine the effects of vane inlet and exit geometries on impeller wear, the wear rate of aluminum oxide bearings in this size pump, and the operating characteristics of the loop. The thoria, a 1600°C-fired oxide, had a mean particle size of approximately 2μ. Average circulating slurry concentration was approximately 450 grams of thorium per kilogram of water and average flow rate was approximately 300 gpm. Attack on the titanium impeller surfaces was so slight that no effects of the various vane configurations could be determined. No measurable bearing wear, either thrust or radial, occurred during the run. Loop operation was deficient in two respects; there was a tendency for thorium oxide to leave the circulating stream and collect in the pressurizer, and the purge-producing capacity was limited. Changing to a pressurizer having full loop flow through the lower end, similar to that of the 200A loop, should eliminate the accumulation tendency. (auth)

19226 CRFD-758

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

FUEL FABRICATION STUDIES RELATED TO THE N.P.D. REACTOR. G. H. Chalder. June 1959. 36p. (AECL-836). $1.00(AECL).

Techniques and equipment are described for the laboratory scale fabrication of uranium dioxide bodies by a cold pressing and sintering route. Results are given of a series of experiments designed to indicate the optimum conditions for the fabrication of high density UO_2 bodies from reduced ammonium diuranate. Methods for applying these results to optimize an industrial flowsheet for UO_2 fabrication are suggested. (auth)

19227 CRFD-759

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE INTEGRAL FABRICATION OF URANIUM DIOXIDE FUEL ELEMENTS BY ROTARY SWAGING. D. L. Paterson and G. H. Chalder. June 1959. 33p. (AECL-841). $1.00(AECL).

The feasibility of fabricating UO_2 fuel elements having densities of 90% theoretical by rotary swaging inside a Zircaloy or stainless steel sheath has been demonstrated. The results show that the density achieved in this process is a function both of the type of UO_2 used and the mechanical properties of the sheathing material. (auth)

19228 DL(S)TN-2011

Gt. Brit. Springfields Works, Springfields, Lancs, England.

A PRELIMINARY INVESTIGATION INTO THE RESISTIVITIES OF SINTERED AND UNSINTERED COMPACTS PRESSED FROM URANIUM POWDER. R. Haynes. Jan. 10, 1952. 22p.

The electrical resistance of sintered and unsintered bars of compacted uranium powders was investigated. The variation of resistance along the length of an unsintered bar and the effect of sintering on resistivity were determined. (W.D.M.)

19229 DMIC-115

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

THE FABRICATION OF TUNGSTEN. V. D. Barth. Aug. 14, 1959. 61p. Contract AF18(600)-1375. (PB-151071). OTS.

The outstanding strength of tungsten is illustrated by a comparison of some of its significant physical properties with those of other metals. The effects produced by heating tungsten are discussed. The most important of these changes is the ductile-brittle transition at about 200 to 400°C, and the effective recrystallization temperature at about 1500°C or above. The consolidation of tungsten by powder-metallurgy procedures and by arc melting is summarized. Considerations of importance in primary working, secondary working, and joining are also summarized. (auth)

19230 DMIC-Memo-20

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

THE PROPERTIES OF MAGNESIUM–THORIUM ALLOYS. R. J. Jackson. May 29, 1959. 29p.

Available engineering data are given for magnesium–thorium alloys which are of interest for structural applications and which are commercially produced or have reached an advanced developmental stage. Attention is given to fabrication of the alloys and design requirements that favor their consideration as materials in air weapons designed for short time service at temperatures of 800 or 900°F. (J.E.D.)

19231 DMIC-Memo-21

Battelle Memorial Inst., Columbus, Ohio.

THE MACHINING OF BERYLLIUM. C. T. Olofson. June 5, 1959. 14p.

Beryllium machines like cast iron but is more abrasive to tools. Its brittle behavior can cause spalling at the exit of cuts and cracking at the surface. During machining, pieces of build-up edge slough off the tool, causing a scuffed, machined appearance. Carbide tools are normally used for turning, milling, and drilling at speeds up to 250, 150, and 100 surface feet per minute, respectively. The recommendation of the Atomic Energy Commission that "for the present it is safest to regard beryllium metal and all its compounds as potentially toxic" is the guiding principle in beryllium safety. Beryllium should be machined in an easy-to-clean, isolated area. The AEC recommendation for a safe beryllium-in-air concentration is 2.0 micrograms or less per cubic meter. Chemical pneumonitis in some persons working with beryllium has been attributed to suspended solid particles or mists of beryllium, its compounds, or solutions of soluble beryllium compounds.

Chip cleanliness is required to maintain the maximum salvage value of beryllium. Cutting fluids are often omitted to prevent chip contamination. (auth)

19232 DMIC-Memo-28
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
REVIEW OF ELECTRICAL MACHINING METHODS. Max J. Trzeciak and Francis W. Boulger. Aug. 5, 1959. 14p.

Recent literature describing the application of the three electrical machining methods, spark discharge, electrolytic grinding and milling, and arc discharge is reviewed. (J.E.D.)

19233 HW-56995
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CORROSION OF ZIRCONIUM, CARBON STEEL, AND STAINLESS STEEL IN HIGH TEMPERATURE WATER. R. J. Lobsinger. Aug. 6, 1958. 11p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

Corrosion data obtained on zirconium, carbon steel, and stainless steel exposed to high-temperature water at pH values from 7.0 to 10.0 are reported. Tests were conducted to support existing data and to determine the important variables in each system. (J.E.D.)

19234 HW-59575
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PHOTOGRAPHIC OBSERVATIONS OF THE GROWTH OF URANIUM DIOXIDE CRYSTALS BY VAPOR DEPOSITION. H. W. Newkirk and J. L. Bates. Mar. 9, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

Photographic observations have been made of uranium dioxide crystals grown by vapor deposition during out-of-reactor and in-reactor experiments. Out-of-reactor experiments were conducted at high temperatures using a tungsten filament furnace in conjunction with a microscope. Photographs of the crystal growth process were taken through the microscope. In-reactor experiments were conducted at high temperatures using a capsule containing powdered uranium dioxide. Photographs were taken during post-irradiation examination. Out-of-reactor results show that crystals grown below 2200°C have a pyramidal habit, whereas crystals grown above 2200°C have a dendritic habit. The crystals grown in the irradiation capsule had a dendritic habit. These results provide temperature data which permit a more accurate estimate to be made of the heat transfer of the fuel core and the power generated by the fuel element during irradiation. A general discussion is presented on the mechanism of dendritic crystal growth by vapor deposition. (auth)

19235 MAB-139-M(S1)
National Research Council. Materials Advisory Board.
FIRST PROGRESS REPORT BY THE PANEL ON SANDWICH MATERIALS AND JOINING OF THE MATERIALS ADVISORY BOARD COMMITTEE ON THE DEVELOPMENT OF MANUFACTURING PROCESSES FOR AIRCRAFT MATERIALS (AMC). July 27, 1959. 31p. Contract DA-36-039-sc-76436.

A discussion is presented of development of manufacturing methods by the panel. A review is presented of various projects on the fabrication of sandwich materials. (W.L.H.)

19236 MAB-152-M
National Research Council. Materials Advisory Board.
REPORT OF THE PANEL ON HIGH-TEMPERATURE BEARINGS. June 9, 1959. 68p. Contract DA-36-039-sc-76436.

The current research on various types of bearings is briefly reviewed. Bearing materials, testing of full-scale bearings, and investigation of lubricants and lubrication systems are discussed briefly. (W.L.H.)

19237 NASA-TN-D-108
Forest Products Lab., Madison, Wis.
RELATIONSHIP OF POLYMER STRUCTURE TO THERMAL DETERIORATION OF ADHESIVE BONDS IN METAL JOINTS. J. M. Black and R. F. Blomquist. July 2, 1958. 36p.

A study was made of adhesives used to bond aluminum and stainless steel and of the resistance of these adhesives to thermal deterioration when aged for 100 hours at temperatures up to 600°F. The phenolformaldehyde, polyamide, and butadiene-acrylonitrile polymers were the most resistant of the single resins used to bond aluminum. The polyamide and butadieneacrylonitrile polymers were most resistant to thermal deterioration of the resins used to bond stainless steel. (auth)

19238 NMI-4710
Nuclear Metals, Inc., Concord, Mass.
DEVELOPMENT AND PROPERTIES OF COEXTRUDED ZIRCALOY-CLAD URANIUM FUEL ELEMENTS WITH INTEGRAL END SEALS. Terminal Report to the Hanford Atomic Products Operation. H. F. Sawyer. Nov. 6, 1958. 83p. Contract AT(30-1)-1565. $2.25(OTS).

Prototype uranium fuel elements clad with Zircaloy and with integral end seals of Zircaloy were fabricated by the coextrusion process. Research and development efforts to produce successful end closures, uniform cladding, and metallurgical bonds are described. Details are given of the breakdown of large diameter stock by primary extrusion for use as billet components, and the fabrication of long lengths of clad rod of 0.630-inch and 1.000-inch diameter is described. (auth)

19239 NMI-9205
Nuclear Metals, Inc., Concord, Mass.
REFRACTORY METAL PHASE DIAGRAMS. Quarterly Progress Report for the Period October 15, 1958 to January 15, 1959. E. J. Rapperport. Feb. 6, 1959. 18p. Contract AF33(616)-6023.

Progress is reported on a program to determine phase diagrams of Ta–Ru, W–Re, Ta–Re, Mo–Hf, and Re–Hf. (W.L.H.)

19240 NP-7767
Massachusetts Inst. of Tech., Cambridge.
END SEAL DEFECTS IN COEXTRUDED REACTOR FUEL ELEMENTS (thesis). Keith G. Lakey and James B. Risser. July 1957. 150p.

The coextrusion process for the fabrication of clad reactor fuel elements is investigated to determine methods of optimizing the typical extrusion "defect" between the core and end seal materials. The influence of cone angle, conical preshaping, and relative material stiffness on the extrusion "defect" is studied under normal production conditions with copper-base alloys. The feasibility of the double extrusion technique with its considerable advantages over conventional methods is demonstrated and shown to be a valuable extension of the coextrusion process. Several undesirable side effects of coextrusion are studied and their major causes isolated. Shift is shown to result primarily from the effects of uneven lubrication of the extrusion tools. The whiskering phenomenon is studied under various conditions; the conclusion is that the difference in flow ve-

locity of the hard and soft materials in the billet is responsible for their formation. Whiskering is shown to be controllable to a degree by billet geometry. (auth)

19241 NP-7772

Aluminum Co. of America. Alcoa Research Labs., New Kensington, Penna.

DEVELOPMENT OF WROUGHT ALUMINUM–MAGNESIUM ALLOYS. Technical Paper No. 14. E. H. Dix, Jr., W. A. Anderson, and M. Byron Shumaker. 1958. 68p.

Data collected over a period of nearly three decades on wrought aluminum–magnesium alloys, leading to the recent development of alloys 5454 and 5456, are presented. Alloy 5456 is the strongest nonheat-treatable alloy commercially available in this country for welded structures. Alloy 5454, the newest member of the family, was introduced for prolonged service at temperatures above those for which the higher magnesium alloys are recommended. A number of tables and charts have been prepared to show the effect of composition, strain hardening, and aging at atmospheric and moderately elevated temperatures on the tensile properties and resistance to corrosion of a variety of alloy compositions. (auth)

19242 NP-7788

Westinghouse Electric Corp. Research Labs., Pittsburgh.

CREEP AND DEFLECTION TESTS ON ZIRCALOY DIAPHRAGMS. Research Report 405FF226-R1. E. A. Davis. Dec. 30, 1958. 50p.

The diaphragms were made of 20 or 25 mil thick cladding of base annealed Zircaloy-2. Argon gas was used as a pressure medium for loading the specimens. The center deflection of the diaphragm was measured by a rod extending vertically out of the test furnace to a dial gage. Test results are discussed, and the data are presented graphically. (J.R.D.)

19243 NP-7809

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

AN X-RAY STUDY OF THE GRAPHITIZABILITY OF COKES OBTAINED FROM PYROLYSIS OF BENZENE AND ITS CHLORODERIVATIVES. Report No. 82/I-B. A. Grossman, Z. Szmid, and M. Szudek. May 1959. 15p.

Benzene, chloro-benzene, m-dichlorobenzene, 1,2,4-trichloro-benzene and hexachloro-benzene were pyrolyzed and the cokes obtained graphitized. X-ray studies confirmed that samples containing an initial excess of hydrogen in relation to chlorine are more rapidly and thoroughly graphitized. (auth)

19244 NP-7849

California. Univ., Berkeley. Minerals Research Lab.

SELF-DIFFUSION IN NICKEL SINGLE CRYSTALS. Technical Report No. 2, Series 114. Issue No. 2. A. Messner, R. Benson, and J. E. Dorn. July 15, 1959. 16p. Contract AF49(638)-58.

Using a sensitive surface monitoring technique, the volume diffusivity of Ni^{63} into Ni single crystals was found to be given by $D = 5.8 \exp(69{,}700/RT)$ over the temperature range from 680 to 830°C. (auth)

19245 NYO-7933

Aeroprojects, Inc., West Chester, Penna.

APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 12 Covering Period from October 1, 1958 to November 30, 1958. Dec. 1958. 28p. Contract AT-(30-1)-1836. $4.80(ph), $2.70(mf) OTS.

Particle size determinations of thorium oxalate precipitates obtained under a wide variety of conditions were made by a modified sedimentation-centrifuge method. The effects of chemical and ultrasonic parameters on particle size are discussed, and the best conditions for precipitation of thorium oxalate in small particle size and narrow size distribution are delineated. In a continuation of the study of thorium dissolution in mercury, additional experiments were run in a stainless steel apparatus at 150°C, with better reproducibility of dissolution rates. The rate of attack of thorium at a power level of 500 watts, pulsed 30 sec on and 30 sec off, was 5.9 $mg/cm^2/hr$ with 95% confidence limits of ± 1.7 $mg/cm^2/hr$. The influence of various geometries and operating conditions on ultrasonic coalescence in a KCl aerosol simulant for radioactive polydispersions was investigated. A six in. diameter by 7 to 9 ft length coalescence tube seems optimum at flow rates up to 2.4 cfm. Essentially the same degree of agglomeration occurred when similar linear velocities were used in units of various diameters. Experimental investigation also showed increased coalescence with increased sonic intensity. (auth)

19246 OOR-1922:1

Carnegie Inst. of Tech., Pittsburgh.

THE GROWTH OF PROEUTECTOID CEMENTITE IN STEELS (thesis). Interim Report No. 1. R. W. Heckel and H. W. Paxton. Feb. 28, 1959. 231p. DA Project No. 599-01-004. Contract DA-36-061-ORD-593.

A complete metallographic survey of the precipitation of proeutectoid cementite from hypereutectoid steels was undertaken. The morphology of the cementite was studied as a function of carbon content of the steel, reaction temperature and reaction time. In conjunction with the morphology study, an investigation of the Widmanstätten cementite habit plane was undertaken. The experimental techniques involved included the direct determination of austenite grain orientations along with a two-trace analysis of the individual cementite plates. In order to understand more thoroughly the mechanism of growth of proeutectoid cementite, a quantitative approach to the question of heterophase interface migration was adopted. Film thickening data when compared to a diffusion controlled rate equation showed that the actual thickening of grain boundary films was proceeding more slowly than predicted. Furthermore, steels containing silicon and manganese deviated more from the calculated values than did a pure steel. A model based upon a finite interface reaction rate and a build-up of silicon in front of the advancing cementite: austenite interface is proposed. (auth)

19247 ORO-204

Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.

STUDY OF THE FILMS FORMED ON ZIRCONIUM–NIOBIUM ALLOYS IN OXYGEN ATMOSPHERES. Final Report. O[tto] Zmeskal and M. L. Brey. June 1959. 106p. Contract AT(40-1)-1826. $16.80(ph), $5.70(mf) OTS.

High-purity Zr, Nb, and 17 alloys of the two metals were heated in O at pressures lower than atmospheric and temperatures in the range 550 to 1090°C. Rates of oxidation at constant pressure and temperature were measured by a volumetric procedure for periods of two to six hours. At 600°C the oxidation of the alloys con-

formed approximately to the parabolic rate law ($w^2 = kt$) during the early stages of oxidation, and rate constants were calculated. At 900°C the general relationship $w^n = kt$ was not followed by any of the alloys in the oxidation process, but all appeared to increase gradually in rate toward a linear relationship. At 1090°C values of n ranging from about 3 for alloys low in Nb to 2 for alloys high in Nb remained approximately constant during the period of measurement. The oxidation of Zr conformed approximately to the cubic rate law over the temperature range of 550 to 900°C, and an activation energy of 42 kcal/mole was calculated. At 1090°C Zr oxidized by the parabolic rate law. Nb oxidized rapidly by an approximately linear rate at both 600 and 900°C. Calculated activation energies for three of the alloys oxidized at temperatures of about 550 to 700°C were 5% Nb (parabolic), 35 kcal/mole; 25% Nb ($n = \frac{5}{2}$), 19 kcal/mole; and 33% Nb (cubic), 21 kcal/mole. The relative reactivities of the alloys toward oxygen varied with temperature. Zr exhibited a lower reactivity toward O than any of the alloys, and Nb oxidized much more rapidly than the alloys. X-ray-diffraction patterns were made of the free oxides formed from the oxidation reactions. Oxidation of the alloys at 900°C resulted in mixed oxides consisting of two or three phases. Monoclinic ZrO_2, orthorhombic $6ZrO_2 \cdot Nb_2O_5$, and the low-temperature form of Nb_2O_5 were formed. As the time of heating was increased, the concentration of the compound increased and the amounts of the separate oxides decreased. A fourth phase, the high-temperature form of Nb_2O_5, was found in most of the oxides formed at 1090°C. (auth)

19248 PB-151173

[Frankford Arsenal. Pitman-Dunn Lab., Philadelphia.]
THE PREPARATION AND PROPERTIES OF EXPERIMENTAL BINARY COPPER–TITANIUM ALLOYS. Report R-1323. W. B. Steward, Jr. and R. C. Harris. Apr. 25, 1952. 36p. Project TB4-202A. $1.00(OTS).

The preparation, heat treatment, and properties of small experimental heats of wrought, age hardenable, binary copper–titanium alloys were investigated over the composition range of approximately 2 to 7% titanium. These alloys were prepared both by induction-melting in air under a flux and by induction-melting in vacuum, using both titanium sponge and titanium scrap of commercial purity. The optimum combination of strength and formability appeared to occur in the vicinity of 94% copper–6% titanium where, by proper choice of heat treatment and degree of cold working, tensile strengths on the order of 160,000 psi accompanied by 3 to 5% elongation were obtained. These properties lie between those of commercial copper–beryllium alloys containing 1 and 2% beryllium. The hardness and tensile properties of vacuum-melted alloys showed no significant improvement over those obtained from air-melted alloys. The vacuum- and air-melted alloys also exhibited similar processing characteristics; both were fully amenable to normal cold working operations but possessed only moderate hot forgeability. (auth)

19249 PIBAL-497

Brooklyn. Polytechnic Inst.
CREEP-STRESS ANALYSIS OF THIN-WALLED STRUCTURES. Sharad A. Patel, K. A. V. Pandalai, and B. Venkatraman. July 1959. 42p. Project No. 9782. Contract AF49(638)-302. (AFOSR-TN-59-665).

Some methods of stress analysis of thin-walled structures subject to creep are presented. It is assumed that the structures considered are maintained at a uniform temperature so that no thermal stresses are present. It is also assumed that the elastic deformations are negligible in comparison with creep deformations. Under these assumptions, the creep problems of thin-walled structures are first reduced to analogous problems of the same structures made of nonlinear elastic materials. The stress analyses are then carried out with particular reference to structures with closed and open cross sections and subjected to pure torsion, bending, and shear. (auth)

19250 RDB(C)/TN-15

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THE INFLUENCE OF CONTAMINATING IONS ON THE CORROSION OF AUSTENITIC CHROMIUM-NICKEL STEELS IN NITRIC ACID. A REVIEW OF PROGRESS TO 1/9/52. H. N. Jones. Nov. 7, 1952. 7p.

Since the discovery that chromate ions accelerated the corrosion of 18/13/1 steel in boiling 70% nitric acid, the effect of other ions has been investigated in an endeavor to elucidate the mechanism of acceleration. It has been found that vanadate, permanganate, and molybdate anions accelerate corrosion, as also does the ceric cation. Neither cobalt nor tungstate ions has a noticeable effect. These tests are now being repeated in a mere quantitative manner. At the same time, an attempt is being made to measure the effect of foreign ions on the solution potential of 18/13/1 steel in nitric acid. It is believed that an apparatus devised by Holler may enable this to be done. (auth)

19251 RDB(R)/TN-2

Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.
A SHORT REVIEW OF PUBLISHED INFORMATION ON THE THERMAL EXPANSION OF ALLOYS IN THE IRON–NICKEL AND IRON–NICKEL–COBALT SYSTEMS. E. S. Smith. Jan. 14, 1952. 11p.

For both these series of alloys the characteristic thermal-expansion curve shows a fairly rapid expansion at low temperature, followed by a temperature interval where the coefficient of expansion is at a minimum, after which at the inflection temperature there is a rapid increase in the rate of expansion. These three stages become less marked as the inflection temperature increases. As the nickel content is increased in the iron–nickel series of alloys, the inflection temperature rises from 155°C at 30% Ni to 590°C at 55% Ni when it becomes indistinct. At the same time the minimum coefficient of expansion decreases reaching a minimum at 36% Ni (1 to 2×10^{-6}/°C) after which it again increases reaching a value of 9.6×10^{-6}/°C at 50% Ni. The addition of cobalt to the iron–nickel alloys raises the inflection temperature as does nickel, without at the same time increasing the minimum coefficient of expansion to the same extent. Consequently, for a given inflection temperature the iron–nickel–cobalt alloy will have a lower minimum coefficient of expansion than the corresponding iron–nickel alloy. (auth)

19252 RDB(W)/TN-104

Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE ARGON-ARC WELDING OF PURE ALUMINIUM AND A SERIES OF ALUMINIUM ALLOYS. D. Shaw and M. G. Hipkins. Dec. 1953. 18p.

The effects of various filler rods on the making of unrestrained butt-welds between combinations of 99.5% Al and NS3, NS4, and HS10 plates have been investigated.

Crack-free welds involving HS4 or HS10 alloy plates were normally obtained when 5% Si or 5% Mg fillers were used. Cracks were generally formed when 99.5% Al, B.A. 25 and 5% Cu fillers were used. Crack-free welds between combinations of 99.5% Al and NS3 alloy were obtained using any of the previously mentioned fillers. In general, it was found that the welds made with the 5% Mg filler contained less porosity than welds made with other filler rods. The tensile strength determinations showed that the strength of the weld was generally greater than that of the adjacent plate material through which fracture invariably occurred. (auth)

19253 WADC-TR-59-78(Pt. I)

Kungliga Tekniska Högskolan, Stockholm.

MEASURING ACCURACY IN CREEP TESTS. PART I. INFLUENCE OF ECCENTRICITY OF LOAD. Period covered: July 1958 to November 1958. Arne Mellgren. Feb. 1959. 27p. Project No. 7360. Contract AF61 (052)-05. (AD-216357).

In the course of an ordinary uniaxial creep test several sources of error may be operative, with the result that the data obtained are not representative of the real properties of the test material. One such source is eccentricity of loading in the various forms that it may assume. The influence that each of several types of loading eccentricities has upon the observed secondary creep rate is determined. Non-uniform creep due to eccentrically applied loads, both initial and time dependent, was considered. The effects of curved test specimens, asymmetric location of extensometers, inhomogeneous materials, and non-uniform cross sections are studied, and mathematical formulas are applied. (auth)

19254 WAL-317/6-1

Howe Sound Co. Central Research Lab., Salt Lake City.

ELECTRODEPOSITION OF COBALT BASE ALLOYS. Interim Technical Report Covering the period October 1, 1956 to April 1, 1957. W. Martin Fassel, Jr., and John P. Baur. July 31, 1957. 74p. DA Project No. 5R01-01-004. Contract DA-04-495-ORD-862 500-1. (AD-157789).

Cobalt–nickel and cobalt–iron binary alloys were electrodeposited from mixed sulfate, mixed chloride, and mixed Watts type baths. Variables investigated included bath composition, temperature, current density, solution pH, and anode type. Special emphasis was placed on relative adherence of Co–Ni alloys deposited from mixed sulfate baths on SAE 4140 steel. An apparently satisfactory pretreatment is described involving anodic etching in a solution of oxalic acid. Electrodeposits of similar composition were obtained from the three bath types having the same ion ratio. The choice of bath then being determined by the physical properties of the deposit. Electrodeposits from mixed sulfate baths appeared to be brighter and smoother than those from the mixed chloride or mixed Watts type although no physical measurements have been made to date. (auth)

19255 WAPD-IPC-743

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] ANNIHILATION OF NUCLEI BY DISPLACEMENT SPIKES. D. E. Thomas. [Nov. 1957]. 8p. $1.80(ph), $1.80(mf) OTS.

At an October, 1957 meeting between USAEC, AECL, and Bettis personnel, the theoretical aspects of the radiation effects on the $\gamma \rightarrow \alpha + \gamma_2$ transformation in U–Nb alloys were discussed. A theoretical model is presented which involves the annihilation of nuclei of the new phase by the action of displacement spikes. (W.D.M.)

19256 WAPD-MP-547

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

REPORT ON PWR EXPERIMENT 11a5: THE CORROSION TESTING OF PLATELETS OF VARYING CLADDING THICKNESS. Earl L. Richards. Mar. 22, 1954. Decl. Aug. 25, 1958. 23p. $4.80(ph), $2.70(mf) OTS.

Zircaloy-2-clad uranium platelets were so designed that cladding thickness could be varied by milling off various amounts. The platelet components were cleaned, assembled in a Ti–Namel jacket, evacuated, welded shut, and rolled to a reduction of 3 to 1. Platelets were prepared with cladding thicknesses of 0.01, 0.02, 0.03, 0.04, 0.06, 0.08, and 0.105 in. Artificial defects were made in the claddings, and the platelets were then autoclave tested at 680°F in water for 24 hours. All specimens failed as anticipated. Cladding distortions decreased as cladding thickness increased. Photographic records of the results are included which indicate the use of 0.03-in. cladding is advisable. (D.E.B.)

19257 WAPD-NCQ(DR)-7

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

LOCATION OF RESIDUAL SPACER MATERIAL IN SUBASSEMBLIES. Inspection Development Report. R. A. Betz. May 18, 1959. 14p. $1.80(ph), $1.80(mf) OTS.

The production of fusion-welded plate-type subassemblies presents certain unusual inspection problems. One of these problems is the location of steel spacer material which has not been completely removed by the pickling process. The inspection method developed at Bettis was based on the Precision Magnetic Field Meter. The PMFM with an additional d-c amplifier and recorder performs a fast, sensitive, and specific test for ferromagnetic materials remaining in subassembly channels after pickling. (W.D.M.)

19258 WAPD-TM-167

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

HIGH-TEMPERATURE WATER AND STEAM-CORROSION BEHAVIOR OF ZIRCONIUM–URANIUM ALLOYS. Stanley Kass. July 1959. 23p. Contract AT-11-1-GEN-14. $0.75(OTS).

Weight change vs. time curves expressing the corrosion behavior of zirconium alloys containing additions of 10 through 60 wt. % uranium tested in 600 and 680°F water and in 750°F steam at 1500 psi are presented. The effects of various heat treatments on the subsequent corrosion properties are also included. (auth)

19259 AEC-tr-3644

A SIMPLE AND RAPID METHOD FOR THE DETERMINATION OF LATTICE CONSTANTS TO WITHIN ± 0.00005 KX BY MEANS OF A COUNTING TUBE GONIOMETER. Fritz Ebert. Translated for Los Alamos Scientific Lab. from Z. Metallk. 45, 436-9(1954). 8p. $1.80(ph), $1.80(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 3593.

19260 AEC-tr-3768

DEFINITION OF THE DIFFUSION COEFFICIENT AND FICK'S EQUATIONS. (Definition des Diffusionskoeffizienten und Ficksche Gleichungen.) W. Seith. Translated for Oak Ridge National Lab. from p.4-21, Chapter

2 of "Diffusion in Metallen," Springer-Verlag, Berlin, 1955. 46p. (Includes original, 18p.). $6.30(ph), $3.00 (mf) JCL.

The definition of the diffusion coefficient is given through the rules of Fick. These were developed from the Fourier concepts on heat conductivity and are valid for ideal gases and ideal solutions. Concepts for Fick rule investigation are given, and a mathematical evaluation of the diffusion methods is presented. A series of experiments is described in which necessary manipulations are carried out. Included are chemical, metallographic, and physical methods. (J.R.D.)

19261 CEA-tr-A-226

PROCESSUS DE PRÉCIPITATION ET CORROSIONS INTERCRISTALLINES DANS UN ACIER AUSTÉNITIQUE INOXYDABLE AU Cr–Ni, CONTENANT DU Nb. (Processes of Precipitation and Intercrystalline Corrosion in A Cr–Ni Stainless Steel Containing Nb.) K. Bungardt and G. Lennartz. Translated into French from Archiv Eisenhüttenw. 29, 359-64(1958). 21p.

Precipitation in an austenite stainless steel containing 0.056% C, 17.93% Cr, 10.92% Ni, and 0.54% Nb was studied during annealing between 500 and 800°C and after tempering from 900 to 1200°C. The study was made by an analysis of the residue separated by attack in an acid solution and by radiographic examination of the fine structure. The results were established as a function of the resistance of the steel to intercrystalline corrosion by a sulfuric solution of copper sulfate. During very high tempering temperatures and for very short annealing times the sensitization to intercrystalline corrosion is retarded. The conditions for the precipitation and dissolution of the carbides of niobium and chromium were determined. (J.S.R.)

19262 CEA-tr-A-324

LE COMPORTEMENT DES POUDRES MÉTALLIQUES COMPRIMÉES. (The Behavior of Compressed Metallic Powders.) F. Skaupy and O. Kantorowicz. Translated into French from Z. Elektrochem. 37, 483-95(1931). 11p.

The behavior of metal powder under pressures up to 4000 atm was studied by a measurement of the variation of the electrical resistance with pressure. The powders tested were tin, lead, graphite, zinc, silver, gold, bismuth, antimony, copper, platinum, nickel, iron, and tungsten. The resistance of soft powders such as tin, lead, and graphite varies less from that of the compact metal than the hard powders such as iron or nickel. The relationship between the metal powders and the metal itself is tabulated, and a compression constant dependent on the preliminary treatment of the powder is also given. The pressure-resistance curve is irreversible. It was established that the increase of resistance depends in a large measure on the duration of high pressures. If a powder remains a long time under a constant pressure, the resistance decreases. (J.S.R.)

19263 CEA-tr-A-365

LA PROTECTION DU MOLYBDÈNE CONTRE L'OXYDATION AUX HAUTES TEMPERATURES. (Protection of Molybdenum Against High Temperature Oxidation.) K. Wassmann. Translated into French from VDI Zeitschrift 99, 421-2(1957). 9p.

There are three methods currently used for the protection of molybdenum against high-temperature oxidation, molybdenum alloys, impermeable inert coating, and coatings formed of stable oxides. The methods for testing the efficiency of the stable oxides in corrosion protection are described. The method of coating the molybdenum with a stable oxide using a spray gun is discussed, and the efficiency of the coatings obtained are reviewed. (J.S.R.)

19264 CEA-tr-A-546

COMBINAISON DE L'ALUMINIUM ET DU CUIVRE PAR FRITTAGE AU MOYEN D'UNE POUDRE Al–Cu AVEC FORMATION DE PHASE LIQUIDE. (Combination of Aluminum and Copper by Fritting by Means of an Al–Cu Powder with Formation of the Liquid Phase.) F. Erdmann-Jesnitzer and A. Arnold. Translated into French by B. Moreau from Metall 12, 179-85(1958). 24p.

A pulverized eutectic mixture of aluminum and copper was combined mechanically by fritting with the formation of an intermediate fused layer. The effects of fritting temperature, pressure, and duration, the state of the sample surface, the quantity and size of the particles in the pulverized mixture, and the addition of fluxes on the stress resistance of the resulting Al–Cu were investigated. It was determined that a critical pressure is necessary to fuse the powder and cause the formation of the alloy. The stress resistance increases rapidly at first with increased pressure, but then after the critical temperature is reached, the resistance increases very little. Increased temperature first causes an increase in stress resistance, but at 590 to 600°C a decrease in stress resistance is caused by higher temperatures. (J.S.R.)

19265 CEA-tr-A-547

EXAMENS PAR OPTIQUE ÉLECTRONIQUE DES COUCHES VAPORISÉES D'In–Sb. (Electron Optical Examination of Vaporized Layers of In–Sb.) L. Reimer. Translated into French from Z. Naturforsch. 13a, 148-52(1958). 15p.

By means of electron diffraction and electron microscopy, the structure of thin layers of InSb vaporized on SiO films (500 A) was examined as a function of the support temperature during the vaporization process. Data on the crystallization capacity of vaporized films of this semi-conductor were obtained. The principal question was the determination of the purity of the InSb in the films. Several electrical measurements of the Hall effect and of the variation of the resistance under the influence of magnetic fields were made on films with thicknesses greater than 1μ. The structure of the film was examined by electron microscopy of surface replicas. (tr-auth)

19266 CEA-tr-A-550

LA PRECIPITATION DU CARBURE LORS DU RECUIT D'ACIERS AU CrNi INOXYDABLES NON-MAGNÉTIQUES. (Precipitation of Carbide During the Annealing of Non-magnetic CrNi Stainless Steels.) B. Strauss, H. Schottky, and J. Hinnüber. Translated into French from Z. anorg. u. allgem. Chem. 188, 309-24(1930). 26p.

The precipitation of carbide in Cr–Ni non-magnetic stainless steels tempered at 1150°C and submitted to various annealing treatments was studied. The effect of the carbide precipitation on the mechanical properties is tabulated. A study of the corrosion resistance shows that the carbide precipitation has no effect on the passivity of the metal up to annealing temperatures of 500°C, but above that temperature effects of the carbide precipitation are found. It was proved that annealing temperatures of 600 to 700°C are critical temperatures for the appearance of intercrystalline corrosion. The

processes of carbide precipitation are described. The modifications to the matrix because of the carbide precipitation are determined by measurement of the magnetic saturation. (J.S.R.)

19267 CEA-tr-A-566
PROPRIÉTÉS DES COUCHES SUPERFICIELLES TRÈS MINCES D'OXYDATION SUR LES MÉTAUX. (Properties of Very Thin Surface Oxidation Layers on Metals.) L. Vlasakova and G. W. Akimov. Translated into French from Werkstoffe u. Korrosion 9, 536-8(1958). 12p.

A study was made of metallic surfaces whose surface apparently had undergone no change, but on which there were invisible surface layers. The thickness of the layer and the kinetics of its growth as a function of pressure were studied by measurements of the ellipticity of reflected and polarized light. The measurement of the emission of exoelectrons gave a determination of the activity of the metallic surface and the effects of the invisible layers on this activity. The variations of ellipticity of reflected light was made on aluminum samples obtained by vaporization. An absorption layer on the aluminum was confirmed. The significance of the absorption layer for the study of corrosion processes was investigated for zinc to determine if the exoemission had its origin in the metal surface or the absorption layer. It was determined that the emission is the result of the ensemble of corrosion processes and can not be assigned to either the absorption layer or the metal itself. Data from copper are also presented. (J.S.R.)

19268 CEA-tr-X-63
LA DIFFUSION DANS LE SYSTEME Cu-Zn. (Diffusion in the Cu–Zn System.) U. Landergren. Translated into French from Jernkontorets Ann. 140, 401-23(1956). 32p.

A compilation of the available data on the self-diffusion and chemical diffusion in copper, zinc, and α, β, and β' brass is presented. Data on the diffusion of zinc in copper by intergranular bonding are also compiled. The probable mechanisms for the different diffusion processes are indicated. 43 references. (tr-auth)

19269 CTS-537
PROPERTIES OF TERNARY ALLOYS OF TITANIUM, CHROMIUM AND ZIRCONIUM DIBORIDES. (Svoistra Troinykh Splavov Diboridov Titana, Khroma i Tsirkoniya.) K. I. Portnoi and G. V. Samsonov. Translated for Dept. of Scientific and Industrial Research, London from Doklady Akad. Nauk S.S.S.R. 116, 976-8(1957). 4p. Price 18s.0d. (United Kingdom) £1.4s. (Overseas) DSIR.

Some properties of the alloys of Ti, Cr, and Zr diborides found on the radial section TiB_2–CrB_2 (50:50 mole %) – ZrB_2 are explained. The specimens were prepared by a hot-pressing sintering method enabling fairly dense briquettes to be obtained from the nonplastic, brittle compounds of the boride type. The conditions of sintering were 2100–2250°C, pressure range 60–330 kg/cm^2, and exposure range 0.5–5 min. (W.D.M.)

19270 CTS-582
MODERN PLANT FOR THE ELECTRO-SPARK WORKING OF METALS. (Sovremennye Ustanovki Dlya Elektroiskrovoi Obrabotki Metallov.) B. R. Lazarenko and N. I. Lazarenko. Translated for Dept. of Scientific and Industrial Research, London from Vestnik Mashinostroeniya 38, No. 5, 65-9(1958). 7p. Price 14s.0d. (United Kingdom) 18s.0d. (Overseas) DSIR.

The electro-spark method of working metals has, in recent years, become widely used in industry. Some of the principal designs and types of electro-spark units are briefly described. (W.D.M.)

19271 HW-tr-5
INFLUENCE OF THE SURFACE STATE ON SOME PROPERTIES OF URANIUM. C. Sella and J. J. Trillat. Translated by Liz Appleby (Hanford Atomic Products Operation) from Rev. mét. 56, 105-21(1959). 38p. $6.30 (ph), $3.00 (mf) JCL.

Electron diffraction studies of uranium during surface reactions were conducted. The influence of the physicochemical surface state on the reactivity of U with O_2 is examined. Reaction conditions resulting in the formation of amorphous, polycrystalline, or epitectic UO_2 are described. Aspects of metal diffusion into U were also studied, and the role of U surface structure in the diffusion mechanism is considered. (J.R.D.)

19272 HW-tr-6
PREPARATION AND SINTERING OF URANIUM UNDER LOAD. J. Dubuisson, A. Hongvet, E. Le Boulbin, R. Lucas, and C. Moranville. Translated by Liz Appleby (Hanford Atomic Products Operation) from Rev. mét. 56, 55-60(1959). 15p. $3.30 (ph), $2.40 (mf) JCL.

Production of sintered U fuel elements was investigated. Fuels having properties comparable to those of pure cast U were prepared from powdered U resulting from the thermal reduction of UO_2 with Ca. The operation proceeds with a 100% return without the necessity for recycling; however, the product is not fine-grained or non-oriented. Proposed experiments for producing carbides and cermets are also discussed. (J.R.D.)

19273 NP-tr-252
CLAMPING DEVICES FOR A TENSILE-TEST MACHINE WITH A WIDE RANGE OF APPLICATIONS. G. Földes. Translated by S. Sitzgerald from Schweiz. Arch. angew. Wiss. u. Tech. 23, 188-93(1957). 12p. $3.30 (ph), $2.40 (mf) JCL. (Figures omitted).

A description is given of a tensile test machine, designed about twenty years ago, and also of a number of applications with clamping attachments specially designed for each particular case. It is shown that although the basic design for a tensile test machine may be relatively simple the clamping conditions for each material and shape of specimen must be studied with special care if the test results obtained are to be truly characteristic of the material. (auth)

19274
INTERNAL DAMPING AS A RESULT OF A REAR RANGEMENT PROCESS. H. Stiller (Technischen Hochschule, Munich). Ann. Physik 3, 283-97(1959). (In German)

With respect to the damping of free torsional oscillations, the internal damping in Ag–Pt, Ag–Mn, Ag–Zn, Ag–Mg, and Au–Cd alloys with varying compositions was investigated in dependence on the temperature. Between 20 and 500°C two maxima in the damping were found in Ag–Zn, Ag–Mg, and Au–Cd alloys, one maximum was found in Ag–Mn, and no maximum was found in Ag–Pt. In Ag–Zn, Au–Cd, and Ag–Mg one of the maxima is the result of a rearrangement of atom pairs of the dissolved component. In Ag–Mn and Ag–Pt the atoms of the dissolved substance are statistically distributed. The damping mechanism is discussed. (J.S.R.)

19275
HAFNIUM RECRYSTALLIZATION DIAGRAM. M. A. Tylkina, R. V. Kirilenko, and E. M. Savitskii. Doklady

Akad. Nauk S.S.S.R. 127, 310-12(1959) June 11. (In Russian)

Metallographic and x-ray-diffraction analyses and measurements of hardness were employed in studies of hafnium deformation and recrystallization properties. The specimens were cold rolled and annealed at 750, 850, 1000, 1150, 1280, 1350, and 1550°C. (R.V.J.)

19276

A STUDY OF THE ELECTRICAL RESISTANCE OF CAST IRON AT HIGH TEMPERATURES. V. K. Titov and V. S. Vanin (Nicolaev Shipbuilding Inst.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 4, 396-9(1959) (In Ukrainian)

The influence of the graphitization of white and grey cast iron upon the electrical resistance at high temperatures was studied. Experiment shows the invariability of the electrical resistance of white cast iron during the process of graphitization of eutectic cementite at temperatures above the critical point. This is accounted for by the equality of the values of the electrical resistance of cast iron phases at high temperatures. At temperatures under the critical point, the lower the temperature at which ρ of cast iron is determined, the more pronounced is the decrease in electrical resistance due to graphitization. (auth)

19277

CATHODIC BOMBARDMENT ETCHING OF NUCLEAR MATERIALS. D. Armstrong, P. E. Madsen, and E. C. Sykes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Materials 1, 127-35(1959) July.

A simple apparatus is described for cathodic etching by ionic bombardment. The etching conditions for a variety of metals, alloys, and ceramics, including thorium, uranium, uranium carbide, and uranium dioxide, are reported. (auth)

19278

THE CORROSION OF AUSTENITIC STAINLESS STEELS UNDER HEAT TRANSFER IN HIGH TEMPERATURE WATER. J. N. Wanklyn and D. Jones (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Materials 1, 154-73(1959) July.

The corrosion of two 18/8 austenitic stainless steels under stress and boiling heat transfer in oxygen-free water at pH 11 and 280°C has been studied. On plane surfaces, heat transfer does not significantly increase corrosion in times up to 1000 hours. In crevices where heat transfer causes superheating and concentration of solutes, stress-corrosion cracking occurs. This is due to the caustic alkali (60 ppm) required to raise the pH to 11: by comparison, a chloride concentration of 0.5 ppm in the bulk water has a negligible effect. Unlike the previously reported stress-corrosion by caustic alkali, the cracking is wholly intercrystalline. The minimum superheat and caustic concentration required to produce it are about 25 to 35°C and 40 to 50 wt. % KOH, respectively. The better-known transcrystalline cracking appears to require higher concentrations than this. In the appropriate solutions intercrystalline corrosion is possible in virtually unstressed metal, but mechanical failure is more rapid at stresses of the order of 20,000 psi (1400 kg/cm$_2$). (auth)

19279

HIGH TEMPERATURE CREEP AND ANELASTIC PHENOMENA IN POLYCRYSTALLINE REFRACTORY OXIDES. Roger Chang (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). J. Nuclear Materials 1, 174-81(1959) July.

High-temperature creep and anelastic phenomena in polycrystalline Al_2O_3 and BeO were studied. The activation energies for both "steady-state" creep and grain boundary relaxation are approximately 2.0×10^5 calories per mole for Al_2O_3 and 1.2×10^5 calories per mole for BeO. Addition of small amounts of Cr_2O_3 or La_2O_3 to Al_2O_3 and of MgO to BeO introduces additional grain boundary relaxation peaks at lower temperatures and reduces grain boundary viscosity. The beneficial effects of these additives in improving the high temperature ductility of refractory oxides are briefly discussed. A correlation between the experimentally observed "steady-state" creep rates and those calculated according to the Nabarro–Herring mechanism from self-diffusion data for BeO suggests that the Nabarro–Herring mechanism may predominate in the creep of polycrystalline BeO and possibly other oxides at high temperatures and low stresses. Further verification of the observation is needed. (auth)

19280

AN EVALUATION OF THE BERYLLIA–WATER VAPOR REACTION IN AN OPEN-CYCLE AIR-COOLED REACTOR. R. L. McKisson (Atomic International Div., North American Aviation, Inc., Canoga Park, Calif.). J. Nuclear Materials 1, 196-202(1959) July.

An expression describing the corrosion rate of a beryllia surface in moist, flowing air has been developed and verified by experiment. The data support the hypothesis that the rate-controlling step in the corrosion process is the diffusion of the gaseous beryllium hydroxide product through the laminar boundary layer at the beryllia surface. The analysis, when used to predict the corrosion rates expected in the operation of an open-cycle, air-cooled, beryllia moderated power reactor, indicates that the corrosion reaction will not limit the feasibility of operation at beryllia surface temperatures below 860°C. (auth)

19281

PRESENT DEVELOPMENTS IN THE PRODUCTION OF HIGH-MELTING METALS. [PART] I. R. Kieffer and F. Benesovsky (Metallwerk Plansee A.G., Reutte/Tirol, Austria). Metall 13, 379-85(1959) May. (In German)

A review is presented of the latest developments in the production of the high melting metals tungsten, tantalum, molybdenum, and niobium. In the first part of the review molybdenum and its alloys and tungsten and its alloys are considered. 42 references. (J.S.R.)

19282

POWDER METALLURGY IN REACTOR TECHNOLOGY. R. Palme (Battelle-Institut E.V., Frankfurt am Main). Metall 13, 386-9(1959) May. (In German)

The application of powder metallurgy to reactor technology is considered, not from an economic viewpoint, but for the obtention of structural and operating materials with specific properties. A brief survey is given of some special powder metallurgical methods used. The production of sintered fuel elements is then discussed with consideration of the sintering of uranium and uranium alloys, dispersion fuel elements, sintered elements from uranium monocarbide, uranium dioxide, and thorium, and fuel elements from impregnated alloys. Sintering of the construction materials magnesium, aluminum, zirconium, beryllium, beryllium, beryllium oxide, and shielding materials is also described. 33 references. (J.S.R.)

19283

THE TITANIUM–MAGNESIUM SYSTEM. I. Obinata,

Y. Takeuchi, and R. Kawanishi (Tohoku Univ., Sendai, Japan). Metall 13, 392-7(1959) May. (In German)

To obtain an equilibrium between titanium and magnesium at high temperatures, an air-tight titanium container, in which a magnesium rod or a mixture of titanium and magnesium in equal parts was placed, was heated to various temperatures up to 1200°C. The results of microscopic, x-ray, and electron diffraction studies confirmed that no intermetallic compound (such as Mg_2Ti) occurs in the titanium–magnesium system. It was also found that the solubility of titanium in magnesium is 0.85 wt.% at 1200°C, 0.30 wt.% at 900°C, and 0.17 wt.% at 700°C. In all cases these results are higher than those found previously. With respect to the solubility of magnesium in titanium, it is doubtful whether the results obtained correspond to the equilibrium state. However, it was found that magnesium dissolves in solid titanium to at least 0.68 wt.% at 1100°C. A phase diagram of the magnesium–titanium system was proposed and is given. (tr-auth)

19284

GAS CONTENT AND HOT SHORTNESS IN ALUMINUM ALLOYS. F. Erdmann-Jesnitzer (Bergadademie, Freiberg i. B.). Metall 13, 405-7(1959) May. (In German)

The hot shortness of aluminum alloys and the effects of hydrogen on it were studied at temperatures up to 850°C in an alloy containing 3% magnesium. The results showed that the brittleness increased with increasing temperatures. The crack length in alloys containing hydrogen was approximately 10 mm less than in those containing no hydrogen. The experimental procedure is described. (J.S.R.)

19285

THE SILICATION AND TITANATION OF IRON, NICKEL, AND COPPER. A. Schneider and J. -P. Siegfriedt (Universitat, Gottingen, Ger.). Metall 13, 546-51(1959) June. (In German)

The possibility of using $SiCl_4$ and $TiCl_4$ to form diffusion coatings on iron, nickel, and copper was investigated. The mechanism of the silication reaction with iron was investigated with $SiCl_4$ in hydrogen or argon atmosphere and with and without Si in the solid phase. The effects of the temperature, silication duration, $SiCl_4$ partial pressure, and the current velocity of the carrier gas were determined. In hydrogen atmosphere there is a weight gain in the sample, and in argon atmosphere there is a weight loss. The results with nickel and copper were comparable. In the titanation of iron and copper no surface reaction was found. However a dull grey to silver white diffusion layer was observed on nickel. The mechanisms of these reactions are discussed. (J.S.R.)

19286

CONTRIBUTION TO OXIDE FORMATION ON MOLYBDENUM. H. J. Booss (Osram G.M.B.H., Berlin). Metall 13, 555-9(1959) June. (In German)

The scaling of molybdenum sheets was investigated between 450 and 550°C. The preliminary treatment, such as annealing or etching, has a strong effect on the absolute value of the scaling constant. Both a structural resolution and a surface roughening increase the scaling constant. From 370 to 380 and from 460 to 470°C a structural transformation of the exterior oxide layer MoO_3 occurs. The transformation is partly responsible for the pitting formation in the temperature range from 450 to 550°C. The activation energy of the scaling velocity in the range from 450 to 550°C is apparently only 46 kcal/mole. This value is affected by surface modifications and structural changes. (tr-auth)

19287

PRODUCTION OF URANIUM AND THORIUM. G. Wirths (Deutsche Gold- und Silber-Scheidenstalt, Zweignieder-lassung Wolfgang, Hanau, Ger.). Metall 13, 621-5(1959) July. (In German)

A survey is presented of the essentials and fundamentals of the methods used in the production of uranium and thorium of nuclear purity. The entire process from the treatment of the ores to the obtention of the metal is considered. 15 references. (J.S.R.)

19288

PROCESSING AND PROPERTIES OF URANIUM. G. Schneider. Metall 13, 625-30(1959) July. (In German)

The chemical, physical, and mechanical properties which are essential for the machining and application of uranium are described. 28 references. (J.S.R.)

19289

PROPERTIES AND PROCESSING OF ZIRCONIUM AND ZIRCONIUM ALLOYS. K. Anderko (Metallgesellschaft A.G., Frankfurt am Main) and E. G. Hess (Vereinigte Deutsche Metallwerke A.G., Duisburg, Ger.). Metall 13, 638-43(1959) July. (In German)

A brief review is given of the chemical, physical, and mechanical properties of zirconium, Zircaloy-2, and zirconium–niobium alloy. The reaction of the metals and alloys with atmospheric gases and hydrogen is described. The conditions for heat and cold working are discussed. Heat treatment of the metal and alloys is also considered. 11 references. (J.S.R.)

19290

PRESENT DEVELOPMENTS IN THE PRODUCTION OF HIGH-MELTING METALS. II. R. Kieffer and F. Benesowsky (Metallwerk Plansee A.G., Reutte/Tirol, Austria). Metall 13, 652-5(1959) July. (In German)

The last part of the review of the latest developments in the production of the high-melting metals tungsten, tantalum, molybdenum, and niobium is presented. In this section tantalum and its alloys and niobium and its alloys are considered. 21 references. (J.S.R.)

19291

PROBLEMS CONCERNING THE UNSTEADY DIFFUSION IN CAST CERAMIC PRODUCTS. V. M. Glasko. Nauch. Doklady Vysshei Shkoly Khim. i Khim. Tekhnol. No. 3, 567-71(1958).

Mathematical methods are used to examine the casting process of ceramic products in relation to the amount of water present in the ceramic material, taking diffusion into account. The experiments were carried out in gypsum cylinders with infinitely thick walls. By means of a suggested formula the concentration of the water in gypsum and slip can be calculated. Also, gypsum cylinders with limited wall thicknesses were used. By means of other suggested formulas, the concentration of the water in gypsum and in slip can be calculated for different variables. (TCO)

19292

CORROSION OF IRRADIATED URANIUM ALLOYS. Sherman Greenberg (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 6, 159(1959) Aug.

As a result of heat treatment under irradiation, Nb–U–Zr alloys exhibited corrosion rates at 260°C in initially pure water as low as 1880 mg/cm²/day. Rates are based on original exposed area. (C.J.G.)

19293

THE CONSTITUTION OF DELTA-PHASE ALLOYS OF THE SYSTEM URANIUM–ZIRCONIUM–MOLYBDENUM. M. S. Farkas, A. A. Bauer, and F. A. Rough (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 215, 685-93(1959) Aug.

An investigation of the δ-phase relationships between the uranium–zirconium and uranium–molybdenum systems was conducted. A ternary cut joining U–31.5 at.% Mo to U–74 at.% Zr is presented on the basis of differential thermal analysis, metallographic, and x-ray diffraction data. Hypothetical isothermal ternary sections, inferred from the determined δ-phase relationships, are presented for the uranium–zirconium–molybdenum system. A ternary eutectoid, at 454°C, was found in zirconium-rich alloys. Its composition, based on metallography and electron-beam microanalysis, is estimated as U–61.7 at.% Zr–7.1 at.% Mo. (auth)

19294

OBSERVATIONS ON THE NIOBIUM (COLUMBIUM)–HYDROGEN SYSTEM. H. W. Paxton (Carnegie Inst. of Tech., Pittsburgh); J. M. Sheehan (U. S. Steel Co., Monroeville, Penna.); and W. J. Babyak (Westinghouse Electric Corp., Pittsburgh). Trans. Met. Soc. AIME 215, 725-7(1959) Aug.

An x-ray examination of specimens of solid niobium reacted in hydrogen from 300 to 1000°C shows the presence of two phases, alpha and orthorhombic. (C.J.G.)

19295

WELD FLAW EVALUATION. Samuel T. Carpenter and Roy F. Linsenmeyer (Swarthmore Coll., Penna.). Welding Research Council Bull. Ser. No. 42, 1-37(1958).

A detailed report is presented on a series of investigations made to determine a basis for the evaluation of the ability of weld flaws to initiate brittle fracture. The report is in four parts dealing successively with (1) brittle fracture mechanics based on the Griffith theory and on Irwin's strain-energy release rate adaptations, (2) static tests on flawed butt welds, (3) static and dynamic tests on small butt weld flaws with and without residual stress, and (4) static tests on weld flaws in a controlled field of high residual stress. All welding flaws in selected materials were simulated flaws, varied to represent lack of penetration, porosity, lack of fusion, or sharp internal weld cracks. The major objective was to examine the effect of given flaws in various environments, in order to determine the environment essential to initiate brittle fracture under low static stress conditions. Low temperature was generally an essential part of the environment, but low static stress initiation could not be procured below the nominal yield point unless the static stress was augmented by either a dynamic stress or a high previously-incurred residual stress. The residual stress environment proved to be most significant. Brittle fractures were initiated from short internal cracks with as small as 2000 psi of applied static stress at temperatures in the order of 0° F. If total brittle fracture did not result, arrested fractures occurred from small buried flaws, with the arrested crack forming a potential source of fracture initiation. Finally, this report emphasizes the important bearing that residual stress has on the brittle fracture problem and the need for extended investigations in brittle fracture mechanics based on strain-energy release rates to furnish a complete engineering basis for flaw evaluation. (auth)

19296

STUDIES OF PALLADIUM–RUTHENIUM ALLOYS. A. A. Rudnitskiĭ and R. S. Polyakova. Zhur. Neorg. Khim. 4, 1405-14(1959) June. (In Russian)

Microstructure, x-ray diffraction analysis, thermoelectromotive forces, and differential thermal analysis were used in studies of the hardness, electric conductivity, and thermal coefficient of palladium–ruthenium alloys annealed at 1400°C. (R.V.J.)

19297

INVESTIGATIONS OF THERMODYNAMIC PROPERTIES OF LIQUID METALLIC SOLUTIONS IN Mg–Pb ALLOYS. M. F. Lantratov (Ulyanov (Lenin) Leningrad Electro-Technical Inst.). Zhur. Neorg. Khim. 4, 1415-19(1959) June. (In Russian)

Measurements were made of the electromotive forces in the concentration chains $Mg/MgCl_2$ + (KCl, LiCl, NaCl)/Mg + Pb in alloys in the temperature range 650 to 700°C. The activity coefficient, partial values for isobar-isothermal potential, and the excess of magnesium and lead potential at 700°C were estimated. (R.V.J.)

19298

ZIRCONIUM CORNER IN THE CONSTITUTION DIAGRAM OF Zr–Sn–Mo ALLOY. O. S. Ivanov and A. T. Semenchenkov. Zhur. Neorg. Khim. 4, 1420-7(1959) June. (In Russian)

Phase studies were made of ternary zirconium alloys containing tin and molybdenum up to 4 at. %. The character of the constitution diagram of zirconium–tin–molybdenum alloy in the zirconium corner and solid state transformation section was analyzed. Alloys containing 10 at. % molybdenum were studied in order to confirm data on the constitution diagrams. (R.V.J.)

19299

HIGH TEMPERATURE MATERIALS. Conference held in Cleveland, Ohio, April 16-17, 1957. R. F. Hehemann and G. Mervin Ault, eds. New York, John Wiley & Sons, Inc., 1959. 556p.

A conference on recent developments in high-temperature materials is presented. In Parts I and II, Ni and Co alloys and cermets are treated. Part III deals with refractory metals. Separate abstracts have been prepared for each of twenty eight papers. (T.R.H.)

19300

STATUS AND FUTURE OF NICKEL-BASE ALLOYS. F. L. Ver Snyder (General Electric Co., Schenectady, N. Y.). p.3-15 in "High Temperature Materials."

Advances in processing of Ni alloys are discussed, and the mechanical properties of some alloys are given to show their usefulness at high temperatures. Compositions are given for 26 alloys. Structure and intergranular fracture are also discussed. (T.R.H.)

19301

INVESTIGATION OF HIGH-TEMPERATURE PROPERTIES OF NICKEL-BASE ALLOYS USING BALANCED-EXPERIMENT DESIGNS. T. L. Robertshaw (Universal-Cyclops Steel Corp., Bridgeville, Penna.). p.16-27 in "High Temperature Materials."

An introduction to the techniques of balanced experi-

mental design is given with particular examples taken from alloy development studies. Some data are given on promising alloys for use above 1750°F. A base alloy of Ni, Cr, Co, and Fe (6:2:2:1) with additions of 0.2% C, 0.002% B, and 0.05% Zr by wt. was tested at 1750 to 1800°F and 15,000 and 18,000 psi. The three experiments involved strengthening additions of Al–Ti–Ta, Al–Ti–W, and Al–Ti–Mo. (T.R.H.)

19302

EVALUATION OF A CAST NICKEL-BASE ALLOY FOR USE AS A BUCKET MATERIAL AT 1650°F. R. A. Signorelli, J. R. Johnston, and J. W. Weeton (Lewis Research Center, Cleveland). p.28-37 in "High Temperature Materials."

Preliminary studies of Guy alloy are described which led to testing as turbine-bucket material at 1650°F. The tests indicate that Guy alloy has considerable potential in this application. (T.R.H.)

19303

W545–A NEW HIGHER-TEMPERATURE TURBINE DISK ALLOY. J. T. Brown and J. Bulina (Westinghouse Electric Corp., Pittsburgh). p.38-55 in "High Temperature Materials."

The generalized effect of boron additions to precipitation-hardening alloys is discussed. The effect on Discaloy stress-rupture properties is shown, and the effect of B on notch sensitivity is discussed. Discaloy is compared with laboratory heats of W545 as to tensile properties, stress-rupture, and fatigue. (T.R.H.)

19304

HISTORY, STATUS, AND FUTURE OF COBALT ALLOYS. Glenn A. Fritzlen (Haynes Stellite Co., Kokomo, Ind.). p.56-80 in "High Temperature Materials."

The history of Co alloys from 1899 is reviewed. The properties of a number of cobalt-containing alloys are plotted versus temperature. (T.R.H.)

19305

ML-1700–CAST TURBINE BUCKET ALLOY. R. J. Morris (General Electric Co., Cincinnati). p.81-94 in "High Temperature Materials."

ML-1700 (Co–25 wt. % Cr–15 wt. % W–0.2 wt. % C–0.4 wt. % B) was evaluated as turbine bucket material for aircraft. The effect of B content was studied, and the mechanical properties were measured. A wheel of ML-1700 buckets was installed and tested at 1700°F in a J-47 engine. Its performance was better than that of any previous Co-base alloy. (T.R.H.)

19306

TEMPERATURE DEPENDENCE OF THE HARDNESS OF SECONDARY PHASES COMMON IN TURBINE BUCKET ALLOYS. J. H. Westbrook (General Electric Co., Schenectady, N. Y.). p.95-115 in "High Temperature Materials."

A study was made of the hardness of a large group of secondary phases of turbine-bucket alloys up to service temperatures. Some general observations are made based on the results, and the results on particular phases are discussed in detail. (T.R.H.)

19307

CERMETS AND BONDED HARD METALS. John T. Norton (Massachusetts Inst. of Tech., Cambridge). p.119-24 in "High Temperature Materials."

Experimental development of cermets and bonded hard metals is discussed. The magnitude of the problem is cited, and emphasis is placed on replacing empirical studies with fundamental research. (T.R.H.)

19308

RECENT DEVELOPMENTS IN SINTERED TITANIUM CARBIDE COMPOSITIONS. J. Wambold and John C. Redmond (Kennametal Inc., Latrobe, Penna.). p.125-39 in "High Temperature Materials."

Methods used for elevated-temperature testing in tension at the Kennametal Laboratory are described, and advancements made in testing methods, high-temperature high-strength compositions, and cemented carbide fabrication techniques are reported. (T.R.H.)

19309

RECENT ADVANCES IN INFILTRATED TITANIUM CARBIDES. Herny W. Lavendel and Claus G. Goetzel (Sintercast Corp. of America, Yonkers, N. Y.). p.140-54 in "High Temperature Materials."

Some of the results of studies of superalloy Co castings strengthened by large proportions of TiC are given. The TiC powder compact skeleton is placed in a mold to which molten metal (Co) is added. The metal infiltrates dividing the TiC particles and forms a dense pore-free body which does not require machining. The microstructure, high-temperature properties, and impact resistance of these structures are discussed. "Graded" and clad components are also discussed. Graded components are cermets in which metal binder content changes along selected directions to improve ductility of surfaces, edges, and tips. (T.R.H.)

19310

WETTABILITY AND MICROSTRUCTURE STUDIES IN LIQUID-PHASE SINTERING. N. M. Parikh and Michael Humenik, Jr. (Ford Motor Co., Dearborn, Mich). p.155-68 in "High Temperature Materials."

It is shown that the microstructure and properties of heterogeneous polyphase alloys sintered in the presence of a liquid phase are determined primarily by surface-energy effects. This principle is applied in some metal–carbide systems in which microstructures as affected by wettability are studied. These systems include WC–Cu, WC–Co, TiC–Ni, TiC–Ni–Mo, nickel glass, and W–Cu. (T.R.H.)

19311

MODES OF FRACTURE AND SLIP IN CEMENTED CARBIDES. N. M. Parikh (Ford Motor Co., Dearborn, Mich.). p.169-81 in "High Temperature Materials."

In systems such as WC–Co there are 5 possible fracture paths as opposed to 2 for pure polycrystalline metals. The modes of fracture in cemented WC and TiC were studied to predict fracture paths in WC–metal and TiC–metal systems. It was concluded that modes of fracture are determined by microstructures which are in turn influenced by relative surface energies. (T.R.H.)

19312

MATERIALS BASED ON INTERMETALLIC COMPOUNDS. Robert Steinitz (Firth Sterling Inc., Yonkers, N. Y.). p.182-9 in "High Temperature Materials."

Some intermetallic compounds are evaluated for use at high temperatures. The systems Cu–Zn, La–Pb, and Al–Ni are considered along with a number of systems between transition metals. Few intermetallic compounds merit further investigation, being brittle, difficult to fabricate, and sensitive to impurities. (T.R.H.)

19313
THE USE OF CERMETS AS GAS-TURBINE BLADING. G. C. Deutsch (Lewis Research Center, Cleveland). p.190-204 in "High Temperature Materials."

A cermet (TiC containing 30 wt. % Ni and 8 wt. % of solid solution of Nb, Ta, and TiC carbides) was tested as turbine blade material in a J-47 jet engine. The study showed that cermets are promising for raising operating temperatures, but research is needed on the problems of fastening to the wheel, inspection, and impact resistance. (T.R.H.)

19314
CHROMIUM-BASE ALLOYS FOR HIGH-TEMPERATURE APPLICATIONS. R. W. Fountain and M. Korchynsky (Union Carbide Corp., Niagara Falls, N. Y.). p.207-28 in "High Temperature Materials."

A historical review is given of the development of Cr and Cr-base alloys for high-temperature applications. Preparation and properties of high-purity Cr and the effects of impurities and alloying on Cr ductility are discussed. (T.R.H.)

19315
TRANSITION TEMPERATURES OF CHROMIUM AND CHROMIUM-BASE ALLOYS. Ernest P. Abrahamson, II and Nicholas J. Grant (Massachusetts Inst. of Tech., Cambridge). p.229-42 in "High Temperature Materials."

A study of the feasibility of a simple deoxygenation and denitrogenation to produce ductile Cr is described. Transition temperatures were measured by a bend test. No difference was noted among commercial electrolytic, thermite, and H_2-purified electrolytic (0.02% Ni) Cr in as-cast condition. Hydrogen-purified electrolytic Cr with 0.008% N_2 had a transition temperature $\frac{1}{3}$ lower than the other grades. The transition temperature is lowered by Ti, Zr, Al, and Be to 300 or 400°F; Si, Ce, and B lower it to 600 to 800°F; C and Nb raise it. (T.R.H.)

19316
OBSERVATION OF SAP AND PRESENT THEORIES FOR ITS REMARKABLE HIGH-TEMPERATURE STRENGTH. Fritz V. Lenel (Rensselaer Polytechnic Inst., Troy, N. Y.). p.321-31 in "High Temperature Materials."

The properties of sintered aluminum powder are discussed because of the applicability of the dispersion-strengthening principle to high-temperature materials. (T.R.H.)

19317
THE DEVELOPMENT OF SAP-TYPE STRUCTURES IN TITANIUM FOR ELEVATED TEMPERATURE SERVICE BY POWDER METALLURGICAL TECHNIQUES. R. W. Jech, A. D. Schwope, and E. P. Weber (Clevite Research Center, Cleveland). p.332-41 in "High Temperature Materials."

The success of dispersion strengthening in SAP has led to efforts toward its application in other metals. With the aim of extending the service temperature of Ti to 1200°F, materials to disperse in Ti were screened. The evaluation of Al_2O_3, ThO_2, and TiC is reported. (T.R.H.)

19318
MOLYBDENUM, ITS ALLOYS AND ITS PROTECTION. Julius J. Harwood (Office of Naval Research, Washington, D. C.) and M. Semchyshen (Climax Molybdenum Co., Detroit). p.243-72 in "High Temperature Materials."

The properties of Mo are reviewed, and tables and graphs are given of data on: compression-creep properties at 1600°F of Mo and 4 high-temperature alloys, tensile strength versus temperature of Mo and Mo–0.5% Ti, stress-rupture properties of Mo and its alloys, 30-sec rupture strength of Mo and other pure metals, solubility of various elements in Mo, hardness of arc-cast Mo, hardness of Mo alloys, and effects of various elements on Mo hardness. Other topics discussed are: hardness and workability, recrystallization behavior, tensile properties, transition-temperature characteristics, creep-rupture properties, Mo–Re alloys, oxidation and protective coatings, and weldability. (T.R.H.)

19319
EFFECTS OF VACUUM MELTING ON GAS CONTENT AND METAL STRUCTURE OF CAST NICKEL-BASE ALLOYS. Charles M. Hammond and Richard A. Flinn (Univ. of Michigan, Ann Arbor). p.345-63 in "High Temperature Materials."

Vacuum melting allows control of gas content and of minor elements of metals and alloys. These two processes are discussed from a thermochemical standpoint, and available experimental data are cited employing Ni alloys as a model. (T.R.H.)

19320
EVALUATION OF VACUUM-MELTED VACUUM-INVESTMENT-CAST NICKEL-BASE ALLOYS. P. W. Beamer and J. J. Eisenhauer (Austenal, Inc., Dover, N. J.). p.364-77 in "High Temperature Materials."

Investigation of vacuum investment casting (VIC) is described. Waspaloy, Udimet-500, and Inco-713 vacuum-cast from large master melts were studied. It was concluded that stress-rupture properties obtained by VIC are equal to or better than those obtained by conventional techniques. Ductility is improved. The use of large previously melted vacuum heats of alloy does not lower or affect the level of properties. (T.R.H.)

19321
CONSUMABLE-ELECTRODE VACUUM REMELTING OF HIGH-TEMPERATURE ALLOYS. R. K. Pitler, E. E. Reynolds, and W. W. Dyrkacz (Allegheny Ludlum Steel Corp., Watervliet, N. Y.). p.378-87 in "High Temperature Materials."

The application of consumable-electrode vacuum remelting to high-temperature alloys is discussed. The benefits from use of this technique are: higher purity, improved forgeability, larger ingot capability, improved mechanical properties, more uniform structure, and response to working and heat treatment. (T.R.H.)

19322
THE EFFECT OF VACUUM MELTING ON THE HIGH-TEMPERATURE PROPERTIES OF NICKEL-BASE SUPERALLOYS. Frank M. Richmond (Universal-Cyclops Steel Corp., Bridgeville, Penna.). p.407-26 in "High Temperature Materials."

It is shown how vacuum melting results in increased high-temperature properties of existing superalloys. Extensive data are given on high-temperature Ni alloys to show how vacuum melting permits increased operating temperatures. (T.R.H.)

19323
THE EFFECT OF ENVIRONMENT ON HIGH-TEMPERATURE CREEP PROPERTIES OF METALS AND

ALLOYS. Donald A. Douglas (Oak Ridge National Lab., Tenn.). p.429-47 in "High Temperature Materials."

A review is presented which is limited to the following types of environmental effects: oxidizing, neutral or inert, reducing, corrosive, and nitriding. (T.R.H.)

19324

THE EFFECT OF TESTING ATMOSPHERES ON THE CREEP-RUPTURE PROPERTIES OF MOLYBDENUM-BASE ALLOYS AT 1800°F. Dean D. Lawthers and M. J. Manjoine (Westinghouse Research Labs., Pittsburgh). p.486-97 in "High Temperature Materials."

The difference in apparent creep strength of Mo alloys at 1800°F observed in He, vacuum, and partial pressures of He was investigated. The rupture strength in vacuum is increased compared to dry-tank He at 1800°F. In He, the rupture strength or time can be increased by stepwise increase of stress. The rupture time can be increased 2 to 4 times by diffusion of a critical amount of gas into the alloy. (T.R.H.)

19325

OXIDATION RESISTANCE OF BINARY CHROMIUM-BASE ALLOYS. Ernest P. Abrahamson, II and Nicholas J. Grant (Massachusetts Inst. of Tech., Cambridge). p.501-9 in "High Temperature Materials."

A study was made of the oxidation resistance of binary alloys of Cr with elements of groups IVA, VA, VIA, VIIA, and VIII. The testing took place in air at 1800°F. Transition elements, except Ir, caused an initial increase in oxidation resistance. This occurs with less than 1 at. % addition and is of the order of 10 or 15 times better than Cr. At 1800°F in air the best alloy studied (70 Cr, 30 Pd) has three times the oxidation rate of Nichrome. As an intermetallic phase is approached, the oxidation resistance increases. (T.R.H.)

19326

THE OXIDATION OF TUNGSTEN AND MOLYBDENUM FROM 1800 TO 2500°F. J. W. Semmel, Jr. (General Electric Co., Schenectady, N. Y.). p.510-19 in "High Temperature Materials."

The oxidation of W between 1800 and 2500°F was studied and compared with Mo. Mo oxidized linearly between 1800 and 2500°F. The rate is insensitive to rate of air flow over a wide range, but Mo oxidizes rapidly in a direct air blast. The oxidation of W goes from linear to parabolic because of oxide melting at about 2260°F. Between 1800 and 2500°F, W oxidizes more slowly than Mo. (T.R.H.)

19327

HIGH-TEMPERATURE OXIDATION OF GAS-TURBINE ALLOYS. John F. Radavich (Purdue Univ., Lafayette, Ind.). p.520-37 in "High Temperature Materials."

The effect of Mo, Co, and W additions on the oxidation of gas turbine alloys was studied from the standpoint of film formation and oxide scale. The materials studied, including Fe–20 Cr–20 Ni–5 Mo–5 Co, Fe–20 Cr–20 Ni–5 Mo, Fe–20 Cr–20 Ni–5 Co, Fe–20 Cr–20 Ni–5 W, Inconel, Udimet 500, and Inco 702, were oxidized 5 and 15 min at 800°C and 10 hours at 1000°C. The film formed at 800°C and the scale formed at 1000°C were studied by optical and electron microscopy, reflection electron diffraction, transmission electron diffraction, x-ray diffraction, and x-ray fluorescence, where possible. (T.R.H.)

19328

PROGRESS IN NUCLEAR ENERGY. SERIES V. METALLURGY AND FUELS. VOLUME 2. H. M. Finniston and J. P. Howe, eds. New York, Pergamon Press, 1959. 671p. $21.00.

The volume is divided into two parts. In part one papers are presented on basic materials. The papers presented in part two deal with solid-state physics and physical metallurgy. Separate abstracts have been prepared for 38 of the papers. (W.L.H.)

19329

ELECTROLYTIC PURIFICATION OF URANIUM. J. E. Antill, D. S. Butler, and E. Barnes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.3-8 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The behavior of the impurities in the purification of uranium by a soluble anode electrolysis technique is discussed. A diaphragm cell is described which allows pure powder to be produced on a semi-continuous basis and be compacted without leaching. (auth)

19330

ZONE MELTING OF URANIUM. J. E. Antill, E. Barnes, and M. Gardner (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.9-18 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Zone melting has been considered as a purification process for small amounts of uranium for experimental purposes. Experiments in a vertical furnace have shown that density differences between an impurity and uranium may be harnessed to increase the purification. Slow zone speeds ($\frac{1}{4}$ in/hr) are necessary to remove soluble metallic impurities while the non-metallic elements, oxygen and carbon, separate at much faster speeds (3 in/hr). Zone melting applied to the removal of fission products from uranium shows most promise as a modified self-slagging process. (auth)

19331

HYDROGEN IN URANIUM. R. Darras and R. Caillat (Commissariat à l'Énergie Atomique, Paris). p.19-27 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Hydrogen can be associated with U either as a hydride or dissolved in the metal. The solubility of H_2 in U depends on the allotropic form of the metal. Two types of hydride, both given by the formula UH_3, have been identified. The first, the α-type, is stable at low temperatures. It is generally accompanied by small amounts of the β-type, into which it is transformed above 140°C. (W.L.H.)

19332

WORK ON THE METALLURGY OF URANIUM IN BELGIUM. Th. Kroll (Société Générale Metallurgique de Hoboken, Belgium). p.28-31 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The production facilities for U metal of nuclear purity from concentrates and high-grade ores are composed of two subdivisions: the chemical treatment, where UO_3 is produced via uranium peroxide, ammonium diuranate, and uranyl nitrate; the metallurgical treatment includes the reduction of UO_3 to UO_2, as well as the fluorination and the reduction of UF_4 to metal. A third section includes production of billets through vacuum remelting, rolling, and the manufacture of fuel elements. (W.L.H.)

19333

THE EXTRACTION METALLURGY OF THORIUM. J. H. Buddery (Atomic Energy Research Establishment,

Harwell, Berks, Eng.). p.35-49 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The possible methods of preparing thorium metal are discussed from the points of view of both theoretical possibility and technical feasibility. The preferred methods are shown to be the reduction of thoria with calcium, the reduction of thorium tetrafluoride with calcium in the presence of a booster, and fused salt electrolysis. The first method yields a very fine metal powder, the second a sponge, and the last a crystalline powder. Additionally, the Van Arkel "hot wire" method may be used to purify crude metal. (auth)

19334

THORIUM. H. A. Wilhelm (Iowa State Coll., Ames). p.50-5 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

A brief survey of reports on aspects of Th metallurgy connected with metal preparation, alloys, and fabrication is presented. (W.L.H.)

19335

THORIUM ARC MELTING. A. H. Roberson (Bureau of Mines, Albany, Oreg.). p.56-62 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Consumable electrode arc melting produces high-quality ingots that are more acceptable than similar metal melted in refractory crucibles. Sponge can be formed into electrodes by several methods. Electrolytic powder may be compacted in suitable briquettes but should be vacuum-sintered before welding if good quality ingots are to be produced. (auth)

19336

INDUCTION MELTING OF THORIUM. P. D. Corzine (Nuclear Metals Inc., Cambridge, Mass.). p.63-5 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Methods and equipment for the induction melting of thorium and thorium alloys are described and compared. Beryllia remains the most useful material, not only for the containers themselves, but for slip linings and washes in crucibles and molds of graphite. The choice of a furnace is shown to be dependent upon product specifications; the advantages of several types are given. Problems of segregation, sub-surface gas, and cracking in alloy melts are treated briefly, and a summary analysis of sixteen 75-lb billets of Th–5.4 wt. % U alloy is included. (auth)

19337

MAGNESIUM AND RELATED LOW ALLOYS. J. Bernard, R. Caillat, and R. Darras (Commissariat à l'Énergie Atomique, Paris). p.69-87 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

A study was made and is presented of the corrosion of Mg and Mg alloys by various media. The grain size growth of unalloyed Mg was studied under pile operating temperatures. The mechanical behavior of Mg and Mg alloys subjected to elevated temperatures was investigated. (W.L.H.)

19338

THE PREPARATION OF METALLIC PLUTONIUM. E. Grison (Centre d'Études Nucleaire, Saclay, France). p.91-7 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The preparation of Pu by the reduction of PuO_2, PuF_4, and PuF_3 with Al, Ca, and Mg is discussed. Various methods for preparing the plutonium fluorides are reported. Methods are presented for the direct preparation of Pu alloys by reducing plutonium fluoride in a crucible with the alloying metal. (W.L.H.)

19339

THE PREPARATION OF PLUTONIUM–ALUMINIUM AND OTHER PLUTONIUM ALLOYS. O. J. C. Runnalls (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.98-118 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The preparation of plutonium–aluminum alloys by the direct reduction of plutonium trifluoride and plutonium dioxide is described. Plutonium trifluoride is reduced more rapidly at 900°C than at 1125°C with liquid aluminum, owing to the evolution of gaseous aluminum monofluoride at the lower temperature. Plutonium dioxide is reduced readily by an excess of liquid aluminum at 1200°C in the presence of liquid cryolite, forming plutonium–aluminum alloys with a plutonium yield above 99%. The preparation of other binary plutonium alloys by the reduction of plutonium fluorides or dioxide with beryllium, gallium, magnesium, silicon, thorium, and uranium is also described. (auth)

19340

ZIRCONIUM ARC MELTING. A. H. Roberson (Bureau of Mines, Albany, Oreg.). p. 121-36 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The extreme reactivity of molten zirconium imposes many restrictions on conventional melting. Induction melting in graphite crucibles adds about 0.35% carbon to the metal. Commercial melting is carried out by consumable electrode arc melting in a water cooled copper crucible. Electrodes may be sponge or machine turnings pressed into briquettes or massive scrap welded into usable shapes. Under optimum conditions melting rates of 10 to 15 lb/min are attained with a power consumption of 0.15 kw-hr/lb.

19341

ZIRCONIUM WELDING. B. L. Baird and E. F. Cook (Atomics International and Missile Development, Downey, Calif.). p.148-58 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

A general survey of available information on the welding of zirconium is presented. Resistance, flash, and tungsten arc welding are discussed but major emphasis is placed on the latter process. Recommended welding techniques and the effect of the welding process variables on the mechanical and physical properties of welded joints are covered. (auth)

19342

FABRICATION OF A ZIRCONIUM CORE TANK. E. C. Miller and G. M. Adamson (Oak Ridge National Lab., Tenn.). p.159-66 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The Homogeneous Reactor Test (HRT) has Zircaloy-2 as the structural material for the core vessel separating the core and blanket solutions. The fabrication of the HRT core vessel is traced from the ingots through forging, forming, and welding of the finished vessel. Various methods used in the fabrication are presented. (W.L.H.)

19343

THE EXTRACTION OF BERYLLIUM. R. G. Bellamy (Atomic Energy Research Establishment, Harwell,

Berks, Eng.). p.169-80 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The extraction of beryllium is a difficult, lengthy and expensive process, owing chiefly to the refractory nature of its ore and to the chemical reactivity and relatively high melting point of beryllium metal. The chief commercial process is the extraction of beryllium hydroxide from beryl using sulfuric acid or a complex alkali fluoride roasting treatment for opening up the ore followed by the magnesium reduction of beryllium fluoride prepared from the hydroxide. The low temperature electrolysis of beryllium chloride offers a potentially purer product, but the production rate is low. A means of enhancing low grade beryllium ores or an extraction process directly applicable to such ores will be of future importance. (auth)

19344

MELTING AND CASTING OF BERYLLIUM. A. Kaufmann (Nuclear Metals, Inc., Cambridge, Mass.). p.181-2 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The melting and casting of Be by various methods are briefly surveyed. (W.L.H.)

19345

FABRICATION VARIABLES RELATED TO TEXTURE AND MECHANICAL PROPERTIES OF BERYLLIUM. Jacob Greenspan (Nuclear Metals, Inc., Cambridge, Mass.). p.183-90 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The anisotropy of fracture and slip, that is, the brittleness and ductility of the beryllium single crystal, is characteristic also of polycrystalline beryllium in which the grains are oriented in a preferred manner. Beryllium with grain orientations resulting from hot-working either uni-directionally or bi-directionally is ductile or brittle in directions given by the anisotropy and orientation of the grains. Textures developed from various hot-working sequences are given, and tensile results are correlated with textures. It is apparent that mechanical properties are dependent to an unusual degree upon fabrication history. (auth)

19346

REACTOR CONTROL MATERIALS. W. Kermit Anderson and Donald N. Dunning (Knolls Atomic Power Lab., Schenectady, N. Y.). p.193-205 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Control materials for nuclear reactors are considered herein, especially from the standpoint of recent developments in the field. Basic criteria for selection of control materials are outlined in the Introduction. The new boron-containing stainless steels are discussed in some detail as are boron alloys with titanium and zirconium. Dispersions containing boron wherein the matrix consists of either titanium or zirconium are discussed. A discussion of hafnium as a control material is presented. Applications of rare earths for reactor control are briefly discussed. Information on irradiation damage of these materials is included. (auth)

19347

URANIUM DIOXIDE. J. R. Johnson (Minnesota Mining and Mfg. Co., St. Paul). p.209-22 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Uranium dioxide is useful as a reactor material for fuel elements both in bulk and granular forms. The physical properties of UO_2, its oxidation behavior, and reactions are discussed. Methods of preparation and fabrication are given followed by a brief survey of the potentialities of UO_2 as a reactor material. The effects of radiation damage and high heat flux in reactor conditions are reviewed. (auth)

19348

THORIUM OXIDE IN CERAMIC APPLICATIONS. C. E. Curtis (Oak Ridge National Lab., Tenn.). p.223-36 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Thorium oxide is conveniently formed into various shapes by any of five methods, the shape being subsequently fixed by a firing operation at 1800°C. Of five forming methods, viz. slip-casting, dry-pressing, isostatic pressing, extrusion, and throwing, slip casting produced the highest bulk density of those reported (96.4% of theoretical) and dry-pressing the lowest (80.2%). A sixth forming method—hot pressing—produced bulk densities up to 97.8% of theoretical. Thoria ceramics fired in air at 1800°C commonly exhibit a modulus of elasticity in the neighborhood of 20×10^6 lb/in.^{2} and a crushing strength of 21×10^4 lb/in.^{2}. Low thermal conductivity (less than 0.01 cal/sec cm^2 cm °C at 1200°C) and a coefficient of linear thermal expansion (10.4×10^{-6} in./in. °C to 1500°C) that is rather high for ceramic materials in general, indicate a rather high sensitivity of heat shock. Some properties of ThO_2 ceramics are enhanced by solid state reactions with certain additives. Thus the bulk density (9.70) of ware containing 0.5 wt. % of CaO, dry-pressed at 10,000 lb/in.^{2} and fired at 1800°C was greater than that of thoria pressed at 10 times the pressure without CaO (d = 9.50). Desirable electrical conductivity properties of thoria ceramics are enhanced by an addition of 5% of Y_2O_3. ThO_2 forms solid solutions with UO_2 in all proportions with little change in properties as UO_2 is added; however, the sintered product offers little protection against oxidation change in the UO_2. (auth)

19349

FABRICATION OF FUEL ELEMENTS FOR THE BORAX-IV REACTOR. Joseph H. Handwerk and Robert A. Noland (Argonne National Lab., Lemont, Ill.). p.239-60 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The BORAX-IV reactor is a light-water cooled and moderated boiling reactor designed to operate at water temperatures up to 417°F and pressures of 300 lb/in.^{2} absolute maximum. The fuel for the reactor is U^{235} supplied by high-fired ThO_2–6.35 wt. % enriched UO_2 right cylinders approximately 0.225 in. in diameter while the blanket (fertile) material, Th^{232} is supplied by high-fired ThO_2 right cylinders of the same diameter. These ceramic pellets are sealed within tubes of aluminum-1 wt. % nickel alloy (Alcoa X-8001) in which the annulus between the pellet and the inside wall of the tube is filled with lead. The procedures for fabricating the ceramic pellets, the tube plates, and the reactor assemblies are described. (auth)

19350

FABRICATION OF URANIUM BASE ALLOY FUEL PLATES FOR THE EXPERIMENTAL BOILING WATER REACTOR. Robert E. Macherey and Charles H. Bean (Argonne National Lab., Lemont, Ill.). p.261-79 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The Experimental Boiling Water Reactor, the first of its type, is currently fuelled with a uranium base alloy

containing 5 wt. % Zr and 1.5 wt. % Nb. The fuel is protected from water corrosion and fission product loss by Zircaloy-2 bonded by a hot-rolling process. The fuel plates are divided into two isotopic concentrations, natural uranium and uranium enriched to 1.44% U^{235}. The plates are in two thicknesses 0.210 in. and 0.273 in.; but the width and the length of all plates are the same, 3⅝ in. and 54 in., respectively. This paper describes the processing used for the production of approximately 1100 fuel plates. Discussed are the making of the uranium base fuel alloy, the fabrication of the cladding components from Zircaloy-2 ingot, the processing of the cladding billets, and the roll-bonding, heat treatment and finishing of the fuel plates. Evaluation of the fuel plates produced is also included. (auth)

19351

ELEMENTS FOR THE GAS-COOLED REACTOR. L. Grainger (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). p.280-94 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

A large and continuously developing program for gas-cooled reactors has been undertaken in Great Britain; this calls for progressive increases in fuel element temperatures and ratings. British experience in the gas-cooled reactor field stems from the BEPO and Windscale piles; the manufacture of fuel elements for these reactors is described. This experience assisted in the development of the Calder Hall fuel elements, the main problems of which, as for the first commercial power stations, are bowing, swelling of the fuel and the mechanical properties of the magnesium cans. Further development will probably lead to the introduction of beryllium cans and, later, ceramic fuels. (auth)

19352

SODIUM GRAPHITE REACTOR FUEL ELEMENTS. B. R. Hayward (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.363-79 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Fuel elements for a sodium graphite reactor consist of multirod clusters or heavy-wall tubular elements of short uranium metal slugs bonded with NaK and jacketed in stainless steel tubes. The principal problems concern producing elements which will operate at high temperatures and have long burn-up periods. The reasons for the choice of specific fuel designs and materials are presented. The problems associated with the various factors which determine operating limitations of these fuel elements are described. The relationship of the fuel element to the reactor design shows the need for full-cycle process control in order to achieve overall low fuel costs. (auth)

19353

NON-DESTRUCTIVE TESTING OF FUEL ELEMENTS. W. J. McGonnagle (Argonne National Lab., Lemont, Ill.). p.380-97 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Methods and techniques for the non-destructive testing of nuclear reactor fuel elements are reviewed briefly. These methods and techniques are divided into the following groups; visual, pressure and leak, penetrant, thermal, radiography, acoustic, electrical, and electromagnetic. Advantages, sensitivity, and limitations are discussed. (auth)

19354

WETTING BY LIQUID METALS. J. W. Taylor (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.398-416 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The wetting of solid metals and ceramics by liquid metals and alloys is of importance in a number of fields of reactor technology. Under ideal conditions, this wetting is controlled by the three interfacial tensions; (1) liquid–vapor, (2) liquid–solid, and (3) solid–vapor, and the dependence of these on temperature and composition is outlined. Some specific cases of wetting are considered to illustrate the general rôle played by each of the three interfacial tensions and the influence of variables affecting wetting behavior is discussed. The rôle of wetting in the application of liquid metals as coolants, to slurry systems, in cermets, and brazing is outlined. (auth)

19355

THE KINETICS AND CRYSTALLOGRAPHY OF THE TRANSFORMATIONS BETWEEN THE PRIMARY PHASES OF URANIUM AND ITS DILUTE ALLOYS. B. R. Butcher (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and A. N. Holden (General Electric Co., Calif.). p.419-29 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The experimental work on the $\beta \rightarrow \alpha$ and the $\gamma \rightarrow \alpha$ phase changes in uranium and its dilute alloys is reviewed, and the nature of these changes is discussed in the light of the present evidence. The subjects requiring future investigation to clarify the work are suggested. (auth)

19356

PREFERRED ORIENTATION IN URANIUM, THORIUM, ZIRCONIUM AND BERYLLIUM. C. J. McHargue and L. K. Jetter (Oak Ridge National Lab., Tenn.). p.430-59 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Preferred orientations developed in uranium, thorium, zirconium, and beryllium by a variety of fabrication processes have been reviewed. The development of the textures was discussed in terms of present theories of texture formation and deformation and annealing mechanisms. Where possible the effect of preferred orientation on physical and mechanical properties was pointed out. (auth)

19357

KINETICS OF TRANSFORMATIONS OF GAMMA-PHASE URANIUM ALLOYS. Frank A. Rough and Arthur A. Bauer (Battelle Memorial Inst., Columbus, Ohio). p.460-74 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Data are presented for the kinetics of transformations in binary uranium–molybdenum alloys and uranium–molybdenum–base ternaries containing small amounts of niobium or platinum. The transformations of uranium 10 and 20 wt. % niobium alloys are discussed. Data are also presented for the 10 wt. % niobium alloy for both isothermal and continuous cooling conditions. Transformation kinetics for binary alloys containing 30 to 70 wt. % zirconium and for a ternary alloy containing 5 wt. % zirconium and 1.5 wt. % niobium are also reviewed. (auth)

19358

RADIATION EFFECTS OF HIGH-ENERGY ELECTRONS IN METALS. C. E. Dixon (Atomics Div., North American Aviation, Inc., Canoga Park, Calif.). p.475-87 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Several electron-irradiation experiments of metals are described. These include determinations of displacement energy in copper and nickel, acceleration of the ordering process in copper–gold alloys, acceleration of a phase transformation in a copper–iron alloy, increase in Young's modulus, hardness and flow stress in copper and electrical resistivity changes in copper at various irradiation temperatures. The usefulness of these kinds of experiments in studying the nature of radiation damage and in adding to knowledge of metal physics is discussed. It is concluded that electron irradiation experiments have improved understanding of the effects of a simple distribution of interstitials on the properties of metals. More experiments will be required before precise predictions of radiation effects can be made. Particular needs are for studies of displacement cross-sections as a function of incident particle energy and of the interactions between lattice defects and impurities and dislocations. (auth)

19359

RADIATION EFFECTS IN STRUCTURAL MATERIALS AT ELEVATED TEMPERATURES. J. C. Wilson (Oak Ridge National Lab., Tenn.). p.488-99 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The very limited data on the joint effects of temperature and irradiation at elevated temperatures are reviewed. The most important conclusion is that the annealing of simple radiation-produced defects must often be accompanied by other solid state processes so that the effects of temperature are not simple. Irradiation and test temperatures must be chosen to simulate conditions of future reactor service to obtain technological data on radiation effects. The effect of irradiation-altered temperature dependence of the properties of metals is briefly reviewed, and the joint effects of stress, temperature, and radiation in creep are discussed. (auth)

19360

EFFECTS OF RADIATION ON MECHANICAL PROPERTIES OF SOLIDS. M. J. Makin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.500-30 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

This article attempts to review present knowledge on the effect of irradiation on the mechanical properties of solids. The major part of the discussion is on metals since, because of their technological importance, the effect of irradiation on their mechanical properties has been studied more thoroughly than that on other classes of solid. Ionic crystals are discussed in some detail, however, and brief mention is made of the effects on polymers. The experimental evidence reviewed includes the effect on creep, hardness, tensile properties (yield strength, etc.), ductile brittle transition temperature, elastic constants, internal friction, and annealing behavior. The various explanations which have been put forward to account for the changes on irradiation are also discussed. (auth)

19361

EFFECT OF NEUTRON IRRADIATION ON CRYSTALLINE AND GLASSY INORGANIC SOLIDS. J. H. Crawford, Jr. (Oak Ridge National Lab., Tenn.). p.531-50 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Research progress since the Geneva Conference in the field of radiation effects in non-metallic systems is surveyed. Particular attention is given to the recent developments in the study of structural and electronic changes in diamond and the silica system that result from fast neutron bombardment. The experimental findings for these systems indicate that inhomogeneous distribution of neutron-produced lattice defects is an important factor in determining the observed changes in physical properties. Optical and magnetic evidence of lattice or network imperfections produced by both fast neutrons and Co^{60} γ rays for fused silica has been reviewed in some detail and correlated with similar information obtained on quartz crystals. New information on radiation induced phase transformations in non-metal systems and radiation effects in ionic crystals is also summarized. (auth)

19362

LOW TEMPERATURE IRRADIATION AND ANNEALING EFFECTS IN GRAPHITE. John E. Hove (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.551-69 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Electrical resistivity, thermoelectric power, thermal conductivity, stored energy, and lattice spacing data are presented for graphite irradiated at low temperatures and subsequently heated to higher temperatures. The irradiation temperatures range from that of liquid helium to 523°K and the bombardment particles used were protons, neutrons, and electrons. The total integrated fluxes of these particles were generally quite low. Although there is little annealing activity below 80°K, almost all the properties were observed to change by a relatively large amount during annealing from liquid nitrogen temperature to room temperature of specimens irradiated at liquid nitrogen temperature or lower. These changes indicate a recovery in most of the properties of some 30 to 50% of the original alteration caused by radiation damage. In interpreting these data by a previously proposed model of the damage in graphite, several points are found where the correlation becomes difficult. In these cases, possible mechanisms are discussed which can still remain in the framework of this model. All of these discussions are of a qualitative or semi-qualitative nature. Proton irradiations were performed at four temperatures (103°, 300°, 423°, and 523°K) and, at least for the low integrated fluxes used, the phenomenon of radiation annealing was only observed at the two highest temperatures. When a sample irradiated at liquid nitrogen temperature was annealed to room temperature, its property values coincided with the values obtained by a room-temperature irradiation. (auth)

19363

ELECTRONIC STRUCTURE OF THE HEAVY METALS. Guy W. Lehman (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.570-8 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The spectroscopic data on the actinide atoms are reviewed. Evidence and arguments are given which indicate that the ground states of the thorium, uranium, and plutonium atoms have $6d^2 7s^2\ ^3F_2$, $5f^3 6d 7s^2\ ^5L_6$ and $5f^5 6d 7s^2\ ^7K_4$ electronic configurations. Existing theoretical energy level calculations are reviewed. It is found that the energy of the 5f level is very sensitive to the form of the potential function. The spectroscopic data are better approximated by using Latter's Thomas-Fermi potential than his Thomas-Fermi-Dirac potential.

Theoretical spin-splitting parameters for the 5f and 6d states of thorium derived from the Thomas-Fermi potential are $\zeta_f = 0.30$ ev and $\zeta_d = 0.16$ ev. Racah's analysis of Th III spectra gives $\zeta_f = 0.13$ ev and $\zeta_d = 0.22$ ev. An interpolation energy band model is proposed for the actinide metals based upon the Slater-Koster simplified LCAO approach. Evidence is presented showing that the valence electrons in Th occupy the 6d bands while those in uranium and plutonium occupy the 5f–6d bands. The 7s states form excited bands. The importance of spin-orbit coupling is stressed. Detailed results on the energy band structure of α-Th are given. Friedel's directed bond approach for describing the energy band structure of uranium metal is discussed and shown to be an over-simplification. The band structure calculations for α-U, β-Th, γ-U, and ϵ-Pu based upon the interpolation-variational model are briefly discussed. (auth)

19364

PLUTONIUM CONSTITUTIONAL DIAGRAMS. F. W. Schonfeld, E. M. Cramer, W. N. Miner, F. H. Ellinger, and A. S. Coffinberry. p.579-99 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The binary constitutional diagrams presented are taken from the report by Schonfeld and Ellinger (1956), with some additions and corrections. Data on which these diagrams are based are in most cases sufficient for tentative conclusions only, and all the diagrams should be considered subject to change and refinement as additional experimental data are determined. (auth)

19365

URANIUM ALLOY SYSTEMS. Arthur A. Bauer and Frank A. Rough (Battelle Memorial Inst., Columbus, Ohio). p.600-11 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Recent uranium alloy constitutional data are presented in the form of diagrams. Crystal structure data for uranium phases and compounds are tabulated. (auth)

19366

THORIUM ALLOY SYSTEMS. Arthur A. Bauer and Frank A. Rough (Battelle Memorial Inst., Columbus, Ohio). p.612-20 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

Recent information concerning thorium alloy systems is summarized in the form of constitutional diagrams and a tabulation of crystal structure data. (auth)

19367

STRENGTH AND CREEP OF URANIUM ALLOYS. B. Boudouresques and M. Englander (Commissariat à l'Énergie Atomique, Paris). p.621-31 in "Progress in Nuclear Energy. Series V. Metallurgy and Fuels. Volume 2."

The strength and creep properties of U–Mo, U–Zr, U–Al, and U–Ti alloys are reported. (W.L.H.)

19368

REACTOR FUEL PROCESSING. Technical Progress Review, Vol. 2, No. 3. Lemont, Ill., Argonne National Laboratory, 1959. 43p. Available from U. S. Government Printing Office, Washington for $0.55 (domestic), $0.70 (foreign).

New base charges for Pu and U^{233} are given. Specifications for irradiated fuel shipping casks are reported. In the preparation of fuel elements for reprocessing, the dejacketing of the elements by mechanical and chemical methods are presented. In mechanical dejacketing, studies are reported on sawing and shearing. Studies are reported on the dissolution of Al, Zr, Zircaloy, and stainless steel in various chemical dejacketing solutions. Modifications of the Redox and Purex processes to improve the processes and to adapt them to nonproduction reactor fuels are discussed. The development of alternate solvents based on organonitrogen and organophosphorus extractants is reported for a number of solvent extraction processes. An ion exchange process is described for the purification of Pu. The purification of Np by ion exchange is reported. The fluoride volatility process for the processing of enriched U–Zr fuel alloys is discussed. A phase diagram is presented for the $NaF-LiF-ZrF_4$ system. In the pyrometallurgical processing the melt-refining process to be used for the ERR-II fuel and the processing of Pu-rich fuels is presented. Volume reduction, reduction to solids, and final disposal methods are described for radioactive wastes. The current production methods for UF_4 are described. The status of development of Th production processes is briefly summarized. The purification of U^{233} and metal production is briefly discussed. (W.L.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

19369 AERE-A/R-2845

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE 7 GeV PROTON SYNCHROTRON MAGNET: GENERAL CHARACTERISTICS OF MODEL A.C. 3. D. A. Gray, A. H. Spurway, and J. J. Wilkins. June 1959. 18p. $0.42 (BIS).

Magnet model A.C. 3 is described, and measurements of its general characteristics under d-c and pulsed excitations are reported. For these measurements, the model was fitted with plane polepieces tapered to give an $n = 0.6$ field law. (auth)

19370 DESY-A2.1

Deutsches Elektronen-Synchrotron, Hamburg.

VORLÄUFIGE FESTLEGUNG DES MITTLEREN RADIUS AUF 48 M. (Preliminary Establishment of the Mean Radius at 48 m.) H. O. Wüster. Sept. 20, 1957. 2p.

The mean magnet radius of the Deutsches Elektronen-Synchrotron was established at a preliminary value of 48 m. The reasons for this decision are discussed. (J.S.R.)

19371 DESY-A2.2

Deutsches Elektronen-Synchrotron, Hamburg.

VORLÄUFIGE SPEZIFIZIERUNG DER LINAC-EIGENSCHAFTEN. (Preliminary Specification of the Linac Properties.) Uwe Timm. Oct. 10, 1957. 4p.

The requirements for the linear accelerator to be used for electron injection into the synchrotron are given from the preliminary parameters established for DESY. The specifications are a final energy of 40 Mev, energy scattering of ± 0.2 Mev (0.5%), angular scattering of $\pm 1 \times 10^{-3}$ rad, beam diameter of 1.0 cm, an operating frequency of 2850 ± 0.3 MHz, and a current intensity of 0.5 amp/pulse. The linear accelerator will be equipped with a cavity prebuncher to modulate the initial velocity of the electrons with the synchrotron frequency (approximately 500 MHz). (J.S.R.)

19372 DESY-A2.6

Deutsches Elektronen-Synchrotron, Hamburg.

GESICHTSPUNKTE ZUR VERRINGERUNG ODER

BESSEREN AUSNUTZUNG DER HOCHFREQUENZLEISTUNG BEIM ELEKTRONEN–SYNCHROTRON. (INSBES, UBER DIE ABKÜRZUNG DER RELATIVEN BESCHLEUNIGUNGSZEIT). (View Point on the Reduction of Increased Utilization of the High Frequency Power in the Electron Synchrotron. (Especially on the Shortening of the Acceleration Time).) G. Schaffer. Dec. 4, 1957. 8p.

The cost of the high-frequency plant is a principal item in the total construction and operating costs of a 6-Bev electron synchrotron. It is therefore advantageous to define those parameters of the machine which have an effect on the magnitude of the necessary h-f power so that the operation and construction of the accelerator is possible with the lowest cost. With this aim, the general dependence of the h-f power on the pulse repetition frequency, conditions of pulse input and cutoff time, and length of the acceleration gap or magnitude of the average field strength is discussed. (J.S.R.)

19373 DESY-A2.13
Deutsches Elektronen-Synchrotron, Hamburg.
KOSTENGEGENÜBERSTELLUNG. (Cost Comparison.) Jan. 29, 1958. 3p.

The construction costs for the CERN proton synchrotron, CEA electron synchrotron, Stanford linear accelerator, and the DESY electron synchrotron are compared. The operating costs of DESY and the linear accelerator are also compared. (J.S.R.)

19374 DESY-A2.17
Deutsches Elektronen-Synchrotron, Hamburg.
MAXIMAL MÖGLICHE HF-LEISTUNG UND TEILCHENSTROMSTÄRKE AM ANFANG DER BESCHLEUNIGUNG. (Maximum Possible HF Power and Particle Current Strength at the Beginning of the Acceleration.) Feb. 5, 1958. 7p.

The h-f power, particle current intensity, and synchrotron phase at the beginning and end of the acceleration period are considered from the viewpoint of effective power output. The effective output with and without correction of the mismatching in phase and magnitude is taken into account. Numerical examples are given. (J.S.R.)

19375 DESY-A2.18
Deutsches Elektronen-Synchrotron, Hamburg.
ERSTE ÜBERLEGUNGEN ZUR STRAHLEXTRAKTION (MULTITURN EJECTION). (First Considerations on Beam Extraction (Multiturn Ejection).) Feb. 6, 1958. 17p.

By means of a multiturn ejector electrons can be ejected from the synchrotron with not more than 5% loss of electrons. Therefore over 90% are ejected within 30 μsec in approximately 12,000 pulses with each pulse about 0.5×10^6 electrons (at 1 μamp mean current in the synchrotron). In addition there are perhaps as many more electrons following (and some preceding) the main pulse. The pulse interval is 2×10^{-9} sec. By use of the multiturn ejector, the angular distribution of the electrons in the pulse is better than that in the synchrotron. (J.S.R.)

19376 DESY-A2.20
Deutsches Electronen-Synchrotron, Hamburg.
ZUSAMMENFASSENDE ÜBERSICHT ÜBER DIE GEBRÄUCHLICHSTEN VERFAHREN ZUR AUSMESSUNG MAGNETISCHER FELDER UND IHRE ANWENDUNG AUF DIE VERMESSUNG EINES SYNCHROTRONMAGNETEN. (Summarized Survey on the Most Usual Methods for the Measurement of Magnetic Fields and Their Application to the Measurement of Synchrotron Magnet.) Mar. 4, 1958. 27p.

The usual methods used for the measurement of magnetic fields — rotating coils, Hall generators, resistance magnetometers, stationary induction coils, spin resonances, and peaking strips — are briefly described. The accuracy and precision of the stationary induction coil coupled with an electronic integrator, which is used for the CERN synchrotron at Geneva, is discussed in some detail. The mounting of the coils and their construction and standardization are also considered. Peaking strips are proposed for the Hamburg magnets and the reasons for this choice are given. An appendix discusses the input time and the wiring of the integrator and current discriminator. (J.S.R.)

19377 DESY-A2.21
Deutsches Elektronen-Synchrotron, Hamburg.
MAGNETSTROMVERSORGUNG IN DER SCHALTUNG NACH WHITE. (Magnet Current Supply in the Wiring Suggested by White.) Mar. 10, 1958. 23p.

To obtain the transient current form needed for the magnet feed, the wiring proposal of White is considered. The basic idea is that the synchrotron magnet needs a given fixed magnet potential circulation. The inductive voltage drop is determined for the insulation of the winding with respect to ground and therefore does not exceed a given value. All magnet sectors are connected in series, and therefore, from these insulation considerations, the winding number must be very small, which leads to high currents and corresponding high transmission cross sections. These difficulties are overcome by dividing the total magnet wiring into equal parts so that the permissible voltage arises in each part. At each part a capacity tuned in resonance is connected in series. The summed voltage of such a unit is then made zero. The same current flows through all magnet sections. The behavior of magnet current supply in this wiring setup is determined with single choke coils and summed choke coils. (J.S.R.)

19378 DESY-A2.22
Deutsches Elektronen-Synchrotron, Hamburg.
NUMERISCHE RECHNUNGEN ÜBER DEN EINSCHUSS-LINAC. (Numerical Calculation on the Input Linac.) Mar. 14, 1958. 13p.

Numerical calculations are made to determine the h-f amplitude damping increased by beam loading, the variation of the phase length of the electron bunch with respect to the wave, and the energy increase of the electron. In the calculations which are carried out for one section of the accelerator it is assumed that the phase width of the electron bunch is zero and that no electrons are lost in the accelerator. Both assumptions in the use of a chopper-buncher system are fulfilled in the first approximation. (J.S.R.)

19379 DESY-A2.25
Deutsches Elektronen-Synchrotron, Hamburg.
ÜBERBLICK ÜBER VERSCHIEDENE MÖGLICHKEITEN DER CAVITY-SPEISUNG INNERHALB EINER BESCHLEUNIGUNGS-EINHEIT. (Survey on Various Possibilities of the Cavity Input within an Acceleration Unit.) May 8, 1958. 6p.

For inphase input of the cavity resonators in the high-frequency system of the synchrotron, several procedures are possible. A fundamental variation of phase is found according to whether the cavities of a group are bound by external or internal coupling elements.

The installations needed to obtain the inphase input for both coupling system are determined. (J.S.R.)

19380 DESY-A2.27
Deutsches Elektronen-Synchrotron, Hamburg.
ANALOGMODELL FÜR DIE TEMPERATURVERTEILUNG UND DEN WÄRMEFLUSS DES RINGTUNNELS UND SEINER UMGEBUNG. (Analog Model for the Temperature Distribution and the Heat Flux of the Ring Tunnel and its Surroundings.) June 24, 1958. 11p.

The equations for two-dimensional heat conduction in the ring tunnel of the Hamburg Electron Synchrotron are derived for an electric analog. The material data for earth, sand, cardboard, and concrete are considered in the determination of the magnitude of the analog model. The parameters of the analog are established. (J.S.R.)

19381 DESY-A2.29
Deutsches Elektronen-Synchrotron, Hamburg.
NEUFESTSETZUNG DER PARAMETER FÜR DESY. (New Establishment of the Parameters for Desy.) Aug. 1, 1958. 5p.

The parameters for DESY are tabulated for 24 and 28 magnet sectors and for FODO magnet order. (J.S.R.)

19382 DESY-A2.31
Deutsches Elektronen-Synchrotron, Hamburg.
SPEZIFIKATIONEN FÜR DEN 40 MEV INJECTOR DES DEUTSCHEN ELEKTRONENSYNCHROTRONS. (Specifications for the 40 Mev Injector of the German Electron Synchrotron.) Aug. 22, 1958. 4p.

The specifications of the 40-Mev linear accelerator of this Hamburg Electron Synchrotron are compiled in final form. The parameters are a final energy of 40 Mev, energy scattering of ± 0.2 Mev (0.5%), angular scattering of $\pm 1 \times 10^{-3}$ rad, beam diameter of 1.0 cm, and current intensity of 0.250 amp/pulse. The operating frequency was established as either 2848 or 2998 MHz. The repetition frequency will be 50 Hz with a pulse length of 1.2 μsec. (J.S.R.)

19383 DESY-A2.32
Deutsches Elektronen-Synchrotron, Hamburg.
DEBUNCHER (NACH EINEM VORSCHLAG VON HERRN STEFFEN). (The Debuncher (According to a Suggestion of Mr. Steffen).) Sept. 16, 1958. 6p.

A debuncher magnet arrangement with a total deflection of zero, in which the beam optics will vary as little as possible, was proposed. Beams of various energies undergo transit time variations. Errors in the system are caused by lens effect in the perpendicular direction through the leakage field for beams with pulse deviations, aperture and chromatic errors, and errors which originate in construction tolerances. These sources of error are discussed. (J.S.R.)

19384 DESY-A2.33
Deutsches Elektronen-Synchrotron, Hamburg.
HF-RINGMODELL. (HF-Ring Model.) Sept. 22, 1958. 6p.

It appeared desirable to prove the results of theoretical investigations of the ring feed system on a model. The selection of the model frequency and the model dimensions are briefly discussed. The cost of an X-band and S-band model are compared. (J.S.R.)

19385 DESY-A2.34
Deutsches Elektronen-Synchrotron, Hamburg.
TEILCHENSEPARATOR MIT GEKREUZTEN ELEKTRISCHEN UND MAGNETISCHEN FELDERN. (VORLÄUFIGE UNTERSUCHUNG.) (Particle Separator with Crossed Electrical and Magnetic Fields. (Preliminary Investigation).) K. G. Steffen. Sept. 29, 1958. 12p.

At particle energies of several Bev it is difficult to separate from each other particles of equal momentum but different rest masses. For this purpose a particle separator with crossed electrical and magnetic fields was proposed, in which the electrical and magnetic power compensates for the desired particle, and particles with varying rest mass are deflected. The basic equations for this separator are derived and illustrated by numerical examples. The question of the technical feasibility is not considered. (tr-auth)

19386 DESY-A2.37
[Deutsches Electronen-Synchrotron, Hamburg].
MAGNETSEKTOR MIT KONSTANTEM FELDGRADIENTEN. (Magnet Sector with Constant Field Gradients.) K. G. Steffen. Oct. 27, 1958. 16p.

Analyzing magnets with constant field and magnetic quadrupole lenses are the customary elements for the separation and focussing of particle beams of high energy. With respect to its focussing properties the magnet sector is represented as a lens with predetermined focussing width and principal axis, and the equations for this are given. The acceptance surface of the elements are investigated for a constant opening width and are represented graphically for various cases. In a sector magnet with constant field, which is described as a pulse analyzing magnet, the beam emittance received depends on extended pulse resolution. This relationship is represented in dependence on various parameters and discussed for various cases. (J.S.R.)

19387 DESY-A2.38
[Deutsches Electronen-Synchrotron, Hamburg].
ÄNDERUNG DER PARAMETER FÜR DESY. (Variation of the Parameter for DESY.) H. O. Wüster. Nov. 6, 1958. 6p.

The DESY parameters reported previously in DESY-A-2.29 have undergone some revisions and additions. The present parameters are tabulated. (J.S.R.)

19388 DESY-A2.40
[Deutsches Elektronen-Synchrotron, Hamburg].
DER INJEKTIONSWEG. (The Injection Method.) Jan. 27, 1959. 18p.

The requirements for the establishment of an injection method from the linear accelerator into the synchrotron are briefly reviewed. The limiting values for the injection system are given with a consideration of the integration of the orbit curve, the theoretical orbit, particles with energy deviations, energy adjustment system, transformation of the phase surface, and the phase surface adaptation system. (J.S.R.)

19389 DESY-A2.42
[Deutsches Electronen-Synchrotron, Hamburg].
REDUKTION DER ENERGIESTREUUNG AM ENDE DES BESCHLEUNIGUNGSVORGANGES. (Reduction of the Energy Scattering at the End of the Accleration Process.) K. G. Steffen. Feb. 2, 1959. 9p.

A method for the incorporation of a "terrace" in the magnet current path of the electron synchrotron is given, and its principal modes of action are investigated. The method consists in the superposition of a short sinusoidal wave on the magnet current by means of an oscillating circuit across a pulse transformer. The behavior of the system is quantitatively described and illustrated by numerical examples for the Deutsches Electronen-Synchrotron. (J.S.R.)

19390 DESY-A2.43

[Deutsches Elektronen-Synchrotron, Hamburg].
SYNCHROTRONSCHWINGUNGEN. (Synchrotron Oscillations.) A. Hermann. Mar. 4, 1959. 23p.

The synchrotron oscillations during electron injection and acceleration to energies of approximately 1 to 2 Bev are analyzed. The non-linear differential equations describing the oscillations are set up, and the method of solution is discussed. An exact solution of the equations is not possible analytically, but numerical examples of solutions were obtained with a computer. The effect of the time-dependent factor on the oscillations is shown. (J.S.R.)

19391 DESY-A2.44

[Deutsches Elektronen-Synchrotron, Hamburg].
VORSCHLAG FÜR EIN RINGDROSSEL-MODELL. (Proposal for a Ring Choke Model.) W. Bothe. Feb. 13, 1959. 16p.

Since it is economically advisable to attach the single choke coil of the current supply control of the synchrotron magnet to a large ring choke, the technical feasibility of constructing such a large unit must be investigated. Therefore a model ring choke was designed and constructed. The construction and design of the ring choke model are described in detail and its parameters are tabulated. The parameters of the magnetic current supply are also presented. (J.S.R.)

19392 DESY-A2.45

[Deutsches Electronen-Synchrotron, Hamburg].
MESSUNG DER EMITTANZ DES LINACS. (Measurement of the Output of the Linac.) U. Timm. Apr. 13, 1959. 14p.

The measurement of the linac output is reviewed. It is shown to what extent it is reasonable to assume a Gaussian distribution of the current density on canonical coördinates. With such a distribution the possibility of linac output measurement can then be studied. The particle density in phase space, particle density after passage through a field-free space, determination of the emittance parameter at the linac output by means of the distance traveled, particle density behind a quadrupole lens, and determination of the emittance parameter by means of quadrupole lens are considered. (J.S.R.)

19393 MURA-490

Midwestern Universities Research Assn., Madison.
CONCERNING THE $\nu/N \rightarrow 1/3$ RESONANCE, IV A. A TRIAL FUNCTION FOR THE LIMITING-AMPLITUDE SOLUTION OF $d^2u/d\phi^2 = (a + b \cos 2\phi)\, u\, B_1/2\, (\sin 2\phi)\, u^2 = 0$. L. Jackson Laslett. June 17, 1959. 9p. Contract AT(11-1)-384. $0.50(OTS).

For comparison with the results given in an earlier report, use of a trial function for the limiting-amplitude solution of the equation given in the title is illustrated for an example in which

$$a = 0.1262875 \qquad b = 1.15$$
$$\nu/N = 0.2997 \qquad B_1 = 1.$$

The trial function employed sine functions of argument $2\varphi/3$, $4\varphi/3$, 2φ, $8\phi/3$, and $10\varphi/3$. The coefficient found for the dominant term appeared to be within one-tenth of a per cent of the computer result and the spatial fixed-point coordinate (for the unstable fixed points situated to the right and left of the symmetry axis at $\phi = 0$, mod. π) within 0.2 per cent; the corresponding fixed-point momentum is found to be somewhat less accurate, due to the enhanced contributions of error from the higher-frequency terms, the error being roughly 3% in this example. (auth)

19394 NP-7811

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
ALTERNATING GRADIENT FOCUSING IN PROTON LINEAR ACCELERATOR. Report No. 80/VII.
S. Kuliński. Apr. 1959. 25p.

It appears that in existing ion linear accelerators the best focusing system is a succession of electric or magnetic quadrupole lenses. These strong focusing or alternating gradient focusing systems are considered in detail. (W.D.M.)

19395 UCRL-8564

California. Univ., Berkeley. Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT. [PART] XIX [FOR] AUGUST, SEPTEMBER, OCTOBER 1958. Walter D. Hartsough. Apr. 1959. 19p. Contract W-7405-eng-48. $0.75(OTS).

A new secondary-particle beam facility was completed which will allow negative particle beams in the momentum range 0.77 Bev/c to 6 Bev/c to be brought out of the Quadrant III curved section. The initial phase involved in the installation of a plunged beam clipper within the magnet aperture in Quadrant I was completed. Continued improvement in ignitron performance was recorded. The investigations of K^+-meson interactions, Σ^+ hyperon decay, and strange-particle production by π^- mesons continued. An experiment was done to measure $\bar{n}$–nucleus and $\bar{n}$–p^+ cross sections. Thirteen target bombardments were made for the Laboratory chemistry group, twenty-four bombardments for external groups. (For preceding period see UCRL-8563.) (auth)

19396

ABOUT THE PRODUCTION OF VERY HIGH ENERGY PARTICLES. Péter Faragó. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 200-24(1957) Mar.-Apr. (In Hungarian)

The most important experimental data may be deduced from scattering processes. For that purpose a defined nuclear, first of all a proton, beam is needed, with high intensity and high (1 to 10 Bev) and homogeneous energy. The fundamental principle of accelerators of various types producing such high-energy particles is described. There is a detailed description of radial and vertical stability of circular accelerators, with respect to accelerators with variable field gradient. (auth)

19397

THE 1 MV VAN DE GRAAFF GENERATOR OF THE DEPARTMENT OF ATOMIC PHYSICS. István Berkes, István Demeter, and Pál Kostka. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 231-47(1957) Mar.-Apr. (In Hungarian)

The high-tension equipment and accelerating device of the 1-Mv free air type electrostatic generator of the Department of Atomic Physics is described. The generator may be used to accelerate electrons up to an energy of 200 to 800 kev. The maximum target current available is 40 μ amp. The high voltage is measured with an accuracy of 1.2 % by means of a calibrated magnetic analyzer. The maximum analyzed electron beam is 8 μ amp. Experiments with the electron beam may be carried out in vacuum as well as in air. (auth)

19398

METHOD FOR FOCUSING CHARGED PARTICLES IN ACCELERATORS. V. I. Danilov and O. V. Savchenko (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.).

Pribory i Tekh. Ekspt. No. 3, 17-20(1959) May-June. (In Russian)

A variation for focusing charged particles in a synchrotron is discussed. The particles are focused by a magnetic field from an iron-bar deflecting electromagnet. It is shown that at a certain iron-bar dimensional ratio the focusing action is equivalent to the quadrupole lens. The lenses are used in order to intensify the density of a polarized 600-Mev proton beam by an order of 3 and for 300-Mev protons by an order of 2.7 at the recording point of the apparatus. (tr-auth)

19399

COMPUTER FOR INVESTIGATING THE MOTION OF PARTICLES IN LINEAR ELECTRON ACCELERATOR. I. F. Kharchenko, R. M. Nikolaev, A. M. Nekrashevich, and P. M. Zeidlits (Inst. of Physics and Tech. Academy of Sciences, Ukrainian S.S.R.). Pribory i Tekh. Eskpt. No. 3, 71-6(1959) May-June. (In Russian)

The computing device is designed for a relatively fast calculation of particle phase motions in an accelerator at given acceleration parameters as well as for finding the parameters of the emitted beam (energy spectra, bunch phase width, and current magnitude). (tr-auth)

19400

THE PRESENT STATE OF THE PROBLEM OF ACCELERATION OF ATOMIC PARTICLES. V. I. Veksler. Soviet Phys.-Uspekhi 1, 54-61(1958) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13 as Abstract No. 3929.

19401

VAN DE GRAAFF GENERATORS. R. G. Herb. p.64-104 of "Handbuch der Physik. Band XLIV. Instrumentelle Hilfsmitel der Kernphysik I." (Encyclopedia of Physics. Volume XLIV. Nuclear Instrumentation I.). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 480p.

The phenomena which cause failure are so poorly understood that the design of a machine must be largely determined by how a previous machine worked. Much of the material presented is a description of the design and limitations of certain machines. Early developments, electrode arrangement, charging method, support structures, the accelerating tube, the ion source and associated equipment, voltage measurement and control, and performance characteristics and limitations of an operational generator are discussed. (W.D.M.)

19402

CYCLOTRONS AND SYNCHROCYCLOTRONS. Bernard L. Cohen. p.105-69 of "Handbuch der Physik. Band XLIV. Instrumentelle Hilfsmitel der Kernphysik I." (Encyclopedia of Physics. Volume XLIV. Nuclear Instrumentation I.). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 480p.

Theoretical discussions are presented on three classes of cyclotrons: the standard cyclotron, the synchrocyclotron, and the azimuthally varying field (AVF) cyclotron. The various orbital stability and phase problems of the three types of cyclotrons are discussed in detail. The physical problems involved in the design of magnets, radiofrequency systems, ion sources, vacuum systems, beam deflection systems, targets, shielding, and controls and interlocks are described. Several miscellaneous subjects are considered. (W.D.M.)

19403

ELECTRON SYNCHROTRONS. Robert R. Wilson. p.170-92 of "Handbuch der Physik. Band XLIV. Instrumentelle Hilfsmitel der Kernphysik I." (Encyclopedia of Physics. Volume XLIV. Nuclear Instrumentation I.). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 480p.

The essence of the synchrotron is that the magnetic guide field need extend only over a very narrow region along the electron orbit instead of over the whole area defined by the orbit. Phase stability, magnets, injectors, pressure effects, radiation emission, oscillations, radiofrequency, and calibration are discussed. (W.D.M.)

19404

THE BETATRON. D. W. Kerst. p.193-217 of "Handbuch der Physik. Band XLIV. Instrumentelle Hilfsmitel der Kernphysik I." (Encyclopedia of Physics. Volume XLIV. Nuclear Instrumentation I.). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 480p.

The betatron is a charged particle accelerator which uses for its accelerating mechanism the electric field produced by a time-varying magnetic flux linking the orbit of the charged particle. Instantaneous and fixed equilibrium orbits, oscillatory and transient aspects of the motion, imperfect fields, and space charge effects are considered under theory of orbits. Practical considerations discussed include types of betatrons, beam extraction processes, magnetic transients, and the vacuum chamber. (W.D.M.)

19405

THE PROTON SYNCHROTRON. G. K. Green and Ernest D. Courant. p.218-340 of "Handbuch der Physik. Band XLIV. Instrumentelle Hilfsmitel der Kernphysik I." (Encyclopedia of Physics. Volume XLIV. Nuclear Instrumentation I.). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 480p.

Three general forms of the proton synchrotron are described. The original one is the constant-gradient, or low-n, synchrotron of which four are operating and at least five are under construction. Extension of energy made the constant-gradient magnets appear too large and expensive, so the alternating-gradient principle was developed. Three A-G proton synchrotrons are being constructed. The fixed-field alternating gradient (FFAG) synchrotron has been explored theoretically in extensive detail. (W.D.M.)

19406

LINEAR ACCELERATORS. Lloyd Smith. p.341-88 of "Handbuch der Physik. Band XLIV. Instrumentelle Hilfsmitel der Kernphysik I." (Encyclopedia of Physics. Volume XLIV. Nuclear Instrumentation I.). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 480p.

The chief advantage of the linear accelerators is the ease with which particles may be introduced at one end and extracted at the other. Applications for linear accelerators and the historical background are discussed. General principles, electron accelerators, and ion accelerators are considered. (W.D.M.)

PHYSICS AND MATHEMATICS

General

19407 AD-210805

Ohio State Univ. Research Foundation, Columbus. SURVEY OF THE LITERATURE ON RADIATION IN THE ATMOSPHERE. Technical Report 1. J. H. Shaw.

Sept. 1958. 177p. RF Project 854. Contract DA-36-039-SC-78153.

A survey of the literature pertaining to radiation in the atmosphere from the sun, the earth, the sky, and the clouds that influences the measurement of atmospheric temperature from sea level up to 150,000 ft has been made. Literature from which evaluations can be made of the errors due to radiation on the measurement of temperature, and of methods and techniques for correcting for these radiation errors, is also included in this survey. The results are presented in the form of an annotated bibliography. (auth)

19408 AE-14

Aktiebolaget Atomenergi, Stockholm.
GARLIC, A SHIELDING PROGRAM FOR GAMMA RADIATION FROM LINE- AND CYLINDER-SOURCES. Matts Roos. June 1959. 41p.

GARLIC is a program for computing the gamma ray flux or dose rate at a shielded isotropic point detector, due to a line source or the line equivalent of a cylindrical source. The source strength distribution along the line must be either uniform or an arbitrary part of the positive half-cycle of a cosine function. The line source can be oriented arbitrarily with respect to the main shield and the detector, except that the detector must not be located on the line source or on its extension. The main source is a homogeneous plane slab in which scattered radiation is accounted for by multiplying each point element of the line source by a point source build-up factor inside the integral over the point elements. Between the main shield and the line source additional shields can be introduced, which are either plane slabs, parallel to the main shield, or cylindrical rings, coaxial with the line source. Scattered radiation in the additional shields can only be accounted for by constant build-up factors outside the integral. GARLIC-xyz is an extended version particularly suited for the frequently met problem of shielding a room containing a large number of line sources in different positions. The program computes the angles and linear dimensions of a problem for GARLIC when the positions of the detector point and the end points of the line source are given as points in an arbitrary rectangular coordinate system. As an example the isodose curves in water are presented for a monoenergetic cosine-distributed line source at several source energies and for an operating fuel element of the Swedish reactor R3. (auth)

19409 AECU-4235

Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. ILLIAC USE AND OPERATION. PART IV. IBM 650 USE AND OPERATION. PART V. GENERAL LABORATORY INFORMATION. Mar. 1959. 24p. Contracts AT(11-1)-415 and Nonr-1834(15). $4.80(ph), $2.70(mf) OTS.

Developments in the high-speed computer program and mathematical methods are summarized. Use and operation of the Illiac and IBM-650 are described. (For preceding period see AECU-4108.) (W.D.M.)

19410 AECU-4236

Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. SWITCHING CIRCUIT THEORY. PART III. ILLIAC USE AND OPERATION. PART IV. IBM 650 USE AND OPERATION. PART V. GENERAL LABORATORY INFORMATION. Apr. 1959. 37p. Contracts AT(11-1)-415 and Nonr-1834(15). $6.30(ph), $3.00(mf) OTS.

Developments in the high-speed computer program and switching circuit theory are summarized. Use and operation of the Illiac and IBM-650 are described. (For preceding period see AECU-4235.) (W.D.M.)

19411 AECU-4237

Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. ILLIAC USE AND OPERATION. PART IV. IBM 650 USE AND OPERATION. PART V. GENERAL LABORATORY INFORMATION. May 1959. 50p. Contracts AT(11-1)-415 and Nonr-1834(15). $7.80(ph), $3.30(mf) OTS.

Developments in the high-speed computer program and mathematical methods are summarized. Use and operation of the Illiac and IBM-650 are described. (For preceding period see AECU-4236.) (W.D.M.)

19412 AECU-4248(Pts.1-5)

Los Alamos Scientific Lab., N. Mex.
FIELD DISTRIBUTION. Ruth M. Hendrickson, comp. June 19, 1959. 155p. Contract [W-7405-eng-36]. (D-BIB-31(Pts.1-5)). $24.30(ph), $7.50(mf) OTS.

Three hundred and thirty references from various abstract journals are presented on static and time variable electric and magnetic field distributions. The period covered is from 1898 to 1958. (W.D.M.)

19413 AECU-4293

Illinois. Univ., Urbana. Electrical Engineering Research Lab.
RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Quarterly Progress Report No. 13 [for] March 1, 1959 to June 1, 1959. P. D. Coleman, W. L. ...nery, R. C. Becker, B. W. Hakki, R. J. Kenyon, J. J. Stafford, and A. W. Swago. July 1, 1959. 44p. Contract AT(11-1)-392. $7.80 (ph), $3.30(mf) OTS.

In order to circumvent power limitation problems in lumped circuit elements or devices using surface properties, work on analyzing wave propagation in nonlinear ferroelectric media is being considered. Attempts to solve nonlinear vector wave equations are being tried. Work on trying to understand and analyze the nonlinear properties of a microwave gas discharge was started. The simple theory of a gas discharge commonly employed is being studied to see if it can be used to predict approximate results. The pulsed, x-band, gas discharge multiplier was scaled down to be tried with a 30 watt CW, 8.6 mm drive. The harmonic power conversion ratios were lower than expected, and some new problems of damage to the discharge post occurred. Various circuit configurations, using resistive diodes to simulate crystals, were studied for frequency conversion characteristics. The problems of matching the driving source and obtaining maximum converted power were investigated. Increased effort was placed on the synthesis of microwave frequency multiplying circuits. A dual resonant cavity which simultaneously resonates at frequency f_0 and Nf_0 is being studied. A sensitive, wave load calorimeter was designed for work in the range 60 to 90 kmc/s which can probably be scaled to 140-220 kmc/s. (For preceding period see AECU-4199.) (W.D.M.)

19414 AE-16

Aktiebolaget Atomenergi, Stockholm.

THE DANCOFF CORRECTION IN VARIOUS GEOMETRIES. I. Carlvik and B. Pershagen. June 1959. 24p.

The mutual shadowing of fuel lumps in a moderator is studied assuming that the source density of resonance neutrons is constant in the moderator, that one collision with a moderator atom removes a resonance neutron from the resonance interval, and that the fuel is black to resonance neutrons. Formulas for the shadowing factor are given for square or circular tubes, parallel plates of finite or infinite width, and parallel circular cylinders. Some numerical results are presented. (auth)

19415 AERE-C/R-2827

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE OPTICAL SPECTRA OF SOME RARE EARTH AND TRANSURANIC ELEMENTS IN THE 1-3 MICRON REGION. PART 1. APPARATUS. L. Bovey and E. B. Steers. May 1959. 23p. $0.63(BIS).

Details of both the sources used and a 100 cm. focus (f/7 aperture) Ebert spectrometer with a PbS detection system are given. Among the sources discussed are the vacuum furnace, positive column, and microwave excited tubes with emphasis on the last. A method to reduce continuous background is noted. The problem of accurate wavelength measurement in the region is also considered and the use of overlapping orders of visible light fringes described. Possible improvements and developments for future work are included. (auth)

19416 AFOSR-TN-59-220

Michigan. Univ., Ann Arbor. Willow Run Labs.

RESONANCE ABSORPTION OF PARAMAGNETIC IONS WITH SPIN 5/2: $CaCO_3$:Mn. Technical Memorandum No. 2616-10-R. Chihiro Kikuchi. Aug. 1959. 39p. Contracts AF49(638)-68 and DA-36-039 SC-78801. (AD-211802).

The theory of the paramagnetic resonance absorption of ions with $S = 5/2$ in crystalline fields of trigonal symmetry is presented using manganous ions in calcite as an example. It is shown that the experimental results observed by Hurd, Sachs, and Hershberger can be accounted for by assuming that the manganous ions occupy the two nonequivalent Ca^{2+} sites at random. Much of the theory presented here is also applicable to Al_2O_3: Fe, which is a potential material for a zero-field maser. (auth)

19417 AFOSR-TN-59-460

Illinois. Univ., Urbana. Electrical Engineering Research Lab.

EFFECT OF HEAVY DOPING ON THE DIFFUSION OF IMPURITIES IN SILICON. Technical Note No. 3. Michael Francis Millea. July 15, 1959. 51p. Project No. 9763. Contract AF49(638)-417. (AD-215265).

The diffusivities of P, Sb, Sn, and In in "intrinsic" (10^{15} impurity atoms/cm^3 or less), heavily doped n-type (5×10^{19} atoms/cm^3), and heavily doped p-type (2×10^{20} atoms/cm^3) silicon have been measured to obtain information on the way diffusion takes place. The measured diffusivities of P and Sb in n-type are twice their values in intrinsic silicon; their diffusivities in p-type are one half those in intrinsic silicon. These changes are in the direction expected for vacancy diffusion. The diffusivity of Sn in n-type is about 50 per cent larger than in intrinsic, whereas in p-type it is about equal to that in intrinsic silicon. Opposite changes are found for the diffusivity of indium; it is about 6 times larger in p-type and about 50 per cent lower in n-type than in intrinsic silicon. Possible diffusion mechanisms for substitutional impurities in silicon are discussed in the light of these and other data. (auth)

19418 AFOSR-TN-59-563

California. Inst. of Tech., Pasadena. Guggenheim Aeronautical Lab.

A SHALLOW-LIQUID THEORY IN MAGNETOHYDRODYNAMICS. L. E. Fraenkel. June 1959. 78p. Contract AF49(638)-476.

The nonlinear and linear 'shallow-water' theories, which describe long gravity waves on the free surface of an inviscid liquid, are extended to the case of an electrically conducting liquid on a horizontal bottom, in the presence of a vertical magnetic field. The dish holding the liquid, and the medium outside it, are assumed to be non-conducting. The approximate equations are based on a small ratio of depth to wavelength, on the properties of mercury, and on a moderate magnetic field strength. These equations have a 'magnetohydraulic' character, for in the shallow liquid layer the horizontal fluid velocity and current density are independent of the vertical coordinate. Some explicit solutions of the linear equations are obtained for plane flows and for axi-symmetric flows in which the velocity vector lies in a vertical, meridianal plane. The amplitudes of waves in a dish, and the amplitudes behind wave fronts progressing into undisturbed liquid, are found to be exponentially damped, the mechanical energy associated with a disturbance being dissipated by Joule heating. The approximate nonlinear equations for plane flow are studied by means of characteristic variables, and it appears that, because of the magnetic damping effect, there is less qualitative difference between solutions of the nonlinear and linear approximate equations at large times than is the case when the magnetic field is absent. In particular, the characteristic curves depart only a finite distance from their 'undisturbed positions'. (auth)

19419 AFOSR-TN-59-639

Michigan State Univ., East Lansing.

ELECTRICAL RESISTIVITY OF THIN METALLIC WIRES. R. G. Satz. July 25, 1959. 45p. Contract AF49(638)-70.

Measurements by Olsen on thin indium wires at low temperatures demonstrated that not only the residual but also the temperature dependent part of the resistivity increases as the wire diameter decreases. It was suggested by Olsen that small angle phonon scattering, which may take electrons to the surface, where they suffer diffuse scattering, might give rise to the observed effect. Since an exact solution of the transport equation in this case is beset with nearly insurmountable difficulties, only an extremely crude analysis similar to that employed by Nordheim was used. Two mechanisms are considered: 1) Electron-phonon scattering, which takes electrons to the surface in a time shorter than τ_{ph}, where τ_{ph} is the electron-phonon relaxation time in the bulk. 2) Electron-electron scattering, which, although of no consequence in the bulk, may also contribute to the resistivity of a thin wire by bringing carriers to the surface. Both processes lead to a size and temperature dependent contribution to the total resistivity of thin wires, although in the temperature region considered here the size dependence of the electron-electron effect is very weak, and thus this

process could account for at most a small part of the observed resistivity. (auth)

19420 AFOSR-TN-59-681
Plasmadyne Corp., Santa Ana, Calif.
A CONTINUOUS HIGH TEMPERATURE GAS FLOW FACILITY FOR MAGNETOHYDRODYNAMIC STUDIES. Vernon H. Blackman. June 26, 1959. 37p. Project No. 4750. Contract AF49(638)-334. (T-1TNO69-334).

The plasma flow facility is described in detail. A gas flow is heated by a gas sustained and stabilized arc, capable of heating a flow of Ar to a stagnation temperature of over 10,000°K. The gas passes through a large diameter mixing chamber, enters a Laval nozzle and then expands into a low pressure supersonic flow. At the exit of the nozzle the gas is confined to a constant diameter channel by means of a water-cooled vycor tube. The gas flow then is cooled by a heat exchanger and exhausted through a vacuum pump. (W.L.H.)

19421 AFOSR-TN-59-716
Stanford Research Inst., Menlo Park, Calif.
LUMINESCENCE OF SOLIDS PRODUCED BY SURFACE RECOMBINATION OF ATOMS. Technical Report No. I. Kenneth M. Sancier, William J. Fredericks, Henry Wise, and William J. Silva. June 15, 1959. 41p. SRI Project No. SU-2480. Contract AF49(638)-353.

During the heterogeneous recombination of atoms on surfaces of solid lumophors the energy released in the process may be converted to luminous energy of the lumophor. The purpose of the present investigation is the elucidation of the mechanism and efficiency of energy transfer. Lumophors based on the CaO and the MgO host lattices and containing various activators were prepared. The luminescence characteristics of these materials when exposed to hydrogen, oxygen, and nitrogen atoms were examined. Included in this investigation are the effects of atom species, atom concentration, lumophor temperature, and lumophor composition. Some luminescence spectra were obtained. Photoluminescence and candoluminescence of some of the lumophors were examined. A model is presented which describes the processes of chemical reaction and energy transfer associated with luminescence produced by heterogeneous atom recombination. (auth)

19422 AFOSR-TN-59-771
Maryland. Univ., College Park.
COLLISIONAL AUGER PROCESS FOR Mu-MESIC ATOMS. Technical Report No. 143. T. B. Day and J. Sucher. July 1959. 7p. Contract AF49(638)-24.

Recently, Bernstein and Wu criticized a previous suggestion by Day and Morrison that de-excitation of a μ-mesic atom might occur by a collision with another atom, wherein an electron of the other atom takes off the released energy. This criticism is discussed, and the previously used cross section is evaluated. (W.D.M.)

19423 ANL-5859
Argonne National Lab., Lemont, Ill.
RE-34, AN IBM-704 REACTOR SHIELDING PROGRAM. M. K. Butler and J. M. Cook. June 1959. 58p. Contract W-31-109-eng-38. $1.75(OTS).

An IBM-704 shielding program is described which solves, by a finite difference method, the multigroup diffusion equation system in slab, cylindrical, or spherical geometry, with a prescribed source distribution given for the highest energy group. A wide choice of boundary conditions has been made available at the outer boundaries and either continuity of flux and current or the "black boundary" condition may be specified at each regional interface. The machine time required to process an average problem is approximately 1 to 2 minutes. This includes reading in the program deck. (auth)

19424 ANL-5987
Argonne National Lab., Lemont, Ill.
THERMODYNAMICS OF UNSTEADY FLOW PROCESSES INVOLVING TRANSFER OF HEAT FOR VENTED CONTAINMENT SYSTEMS. J. C. Heap. July 1959. 69p. Contract W-31-109-eng-38. $2.00(OTS).

The first law of thermodynamics for changes of state and quantity of the working substance in the case of unsteady flow is presented. Included are mass balance, forms of energy utilized, and definitions of stagnation enthalpy and stored energy. From the equations for unsteady flow the familiar equations for steady flow are deduced. A special case of the first law of thermodynamics for changes of state and quantity is applied in the theoretical derivation on emptying of a vented containment structure having a constant heat source. The appropriate thermodynamic relations necessary for evolvement are stated and a résumé on nozzle flow is made. Graphs were plotted for the air temperature, pressure, and mass with respect to time for the constant-pressure and constant-volume processes; for a large vent and a small vent where the same initial pressure is prevalent to the containment structure and atmosphere; and for heating the internal gas to a predetermined pressure and then releasing through a large vent or a small vent. The resultant thermodynamic relations are applied to a hypothetical containment system to illustrate their generality. This hypothetical containment system consists of an extinguishing system, containment structure system, and a venting system. Tables of functions for various nozzle flow relations are given. The basic first order equation is transformed for use in conjunction with the tables and a desk computer. The essential equations for numerical integration and a numerical example are related. (auth)

19425 ANL-6027
Argonne National Lab., Lemont, Ill.
ANALOGUE COMPUTER SOLUTION OF THE NONLINEAR REACTOR KINETICS EQUATION. Lawrence T. Bryant and N. Frank Morehouse, Jr. July 1959. 31p. Contract W-31-109-eng-38. $1.00(OTS).

19426 APAE-Memo-177(Rev.)
Alco Products, Inc., Schenectady, N. Y.
NUCLEAR EXCURSION ANALYSIS ON THE IBM 650 (EARLY CODE). Earl M. Reiback and Clifford J. Stueck. Feb. 26, 1959. Revised July 10, 1959. 16p. $3.30(ph), $2.40(mf) OTS.

The Early Program is designed to compute the peak power and total energy release which will occur in a reactor due to a step increase of reactivity. These excursions may be terminated by one of several automatic shutoff mechanisms caused by the power excursion itself. The calculation assumes no thermodynamic delays and assumes void formation is due to heat conduction from the cladding to the moderator. (W.D.M.)

19427 APEX-489
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
SPACE-ENERGY CELL HOMOGENIZATION. B. H. Duane and M. J. Stanley. July 1959. 169p. Contracts AF33(600)-38062 and AT(11-1)-171. $3.00(OTS).

Fine-structure nuclear analysis program S was extended to provide properly averaged nuclear data for gross-structure analysis work. The input extension consists of the gross-structure space-energy lattice. Cell homogenization is performed by direct space-energy integration of each of the reaction-rate terms in the transport equation, with preservation of the detailed balance of leakage, collision, scatter-transfer, fission production, and fixed-source production. On a flexible flux-or-adjoint weighted space-energy cell basis, the extended output includes: cell-homogenized cross sections for collision, absorption, scatter, scatter-transfer, and fission multiplication; field depression or accentuation; leakage; surface albedo; and field diffusion coefficient, with inclusion of lumped-void leakage enhancement and other fine-structure heterogeneity effects. Specific areas of immediate engineering applicability in GE-ANPD fuel loading and gross power shaping work on epithermal reactors include: (1) two-energy albedo input to program K with inclusion of the effects of complex control rod cell structure and of energy degradation within a control rod cell, (2) complete three-energy input to program CURE and to program F_3 with inclusion of the effects of fine-structure void channels and strong absorbers and of three-energy control-rod cell albedos, and (3) nineteen-energy flux depression factors and control-rod cell albedos for input to program G_2. (auth)

19428 ASRL-TR-76-2

Massachusetts Inst. of Tech., Cambridge. Aero-Elastic and Structures Research Lab.

ON LARGE DEFLECTION OF CURVED STRIPS UNDER COMBINED THERMAL AND PRESSURE LOADINGS. M. M. Chen. May 1959. 63p. Project No. 9782. Contract AF49(638)-160. (AFOSR-TN-59-676).

The governing equations in various forms for large deflections of initially curved strips, including thermal force and thermal moment effects, are derived based on Reissner's variational principle. Exact solutions are obtained for the cases corresponding to net tensile, compressive, and zero in-plane forces with arbitrary distributed, thermal loads, and small initial curvature. Numerical examples are given for a clamped-clamped strip with a particular initial shape, temperature distributions, and uniform pressure. For the purpose of comparison, approximate solutions based on Reissner's variational principle and minimum potential energy are obtained. In both methods, the vibrational modes, and assumed modes are used. Good agreement is shown in the numerical examples. These approximate methods of solution are used for the case of finite plates. (auth)

19429 BM-RI-5497

Bureau of Mines.

SOLUTION TECHNIQUES IN FLUORESCENT X-RAY SPECTROGRAPHY. William J. Campbell, Melvin Leon, and John W. Thatcher. Nov. 19, 1958. 28p.

The applications and limitations of solution techniques as a general method of fluorescent x-ray spectrographic analysis were determined. Systematic errors due to variations in particle size, surface preparation, and sample inhomogeneity are eliminated by the use of solutions. The range of applicability of fluorescent x-ray spectrography is increased by samples in the form of wire, filings, turnings, etc., which can be analyzed as solutions, and samples submitted as solutions which can be analyzed as received. The lower limit of detectability varies from 0.14 gram per liter for sulfur to 0.0015 gram per liter for strontium. Most elements have limits of detectability between 0.02 and 0.002 gram per liter. (auth)

19430 BNL-557

Brookhaven National Lab., Upton, N. Y.

A STUDY OF THE WIND PROFILE IN THE LOWEST 400 FEET OF THE ATMOSPHERE. Progress Report No. 3 [for] January 15, 1959–June 15, 1959. Irving A. Singer and Gilbert S. Raynor. 14p. DA Project No. 3-99-04-112. Contract No. 5-65-8-99812 SC-04-91. $0.50(OTS).

The construction and operating characteristics of the Brookhaven wind tunnel are described, and its use in Aerovane calibration is reported. The Aerovanes calibrated for use in this project were found to be well matched. The automatic data processing system and the analysis of a sample run are described. The spectra obtained from this analysis are presented. (auth)

19431 CF-59-8-68

Oak Ridge National Lab., Tenn.

MEASUREMENT OF THE "ACTIVE DEPOSIT" OF THORON. S. A. Reynolds. Aug. 17, 1959. 6p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

A description is given of the properties of the nuclides included in the "active deposit" of thoron. A method is presented for obtaining a quantitative measurement of the activity of the transient-equilibrium mixture. (auth)

19432 CU-191

Columbia Univ., New York. Pupin Cyclotron Lab. and-Columbia Univ., New York. George B. Pegram Lab.

PROGRESS REPORT FOR JANUARY, FEBRUARY, MARCH 1959 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. 34p. Contract AT-30-1-GEN-72. $6.30(ph), $3.00(mf) OTS.

Neutron Physics. The large $B^{10}(n,\alpha)Li^7$ scintillation detector for the 475 kev γ ray has been improved to take continuous counting rates over 700,000 counts/sec with a 20% resolution for the Cs^{137} line. Design and construction of a scintillation chamber to study mass distribution in U^{235} fission by p-wave neutrons is reported. Operation of the high-pressure gas scintillator for measurement of (n,p) cross section is reported. The useful range of the neutron crystal spectrometer at Brookhaven Reactor was extended. Procedures for obtaining samples of U^{235}, U^{233}, and Pu^{239} for cross section measurements are described. Charged Particle Investigations. Cyclotron alterations continued. Angular distribution studies of the $Ne^{20}(d,n)$, $F^{19}(d,n)$ and $N^{14}(d,n)$ reactions are reported, along with investigations of: gamma angular distribution following the $N^{14}(p,p')N^{14}$ reaction, (p,n) threshold energy measurements, production of O^{15} and F^{17} activities for magnetic moment determination, and electric monopole internal conversion in O^{16} and Ca^{40}. Theoretical Investigations. The circular polarization of the γ in coincidence with the β from unoriented Co^{60} nuclei was studied. Instrument Development. Brief descriptions are given of work on: 2,000-channel time-of-flight analyzer, NaI crystal detectors for Nevis velocity selector, 10-amp regulated current supply, current integrator, magnet power supplies, and components for automation. Light Particle Investigations. Work on the He^6 beta-neutrino angular correlation experiment is reported. (For preceding period see CU-184.) (T.R.H.)

19433 D-16717

Boeing Airplane Co., Seattle.

GENERATING AND TESTING RANDOM NUMBERS ON THE IBM TYPE 701. D. L. Johnson. Mar. 8, 1955. 16p.

The Monte Carlo technique employs repeated sampling to stimulate physical problems directly. The physical experiment is replaced by a mathematical model within a computer; physical relations are replaced by mathematical relations and random physical events are replaced by numbers selected from a set of random numbers. A supply of random numbers is needed which are distributed in a manner resembling the true distribution of the physical quantity which they represent. (W.D.M.)

19434 GA-93(Add.)

General Atomic Div., General Dynamics Corp., San Diego, Calif.

NEUTRON-FLUX DISTRIBUTION IN A CYLINDRICAL CELL OBTAINED BY THE S_4 APPROXIMATION TO THE TRANSPORT EQUATION. ADDENDUM. L. W. Nordheim and Egil K. Bjørnerud. May 3, 1957. 10p. Project No. 17b. For Aktiebolaget Atomenergi, Stockholm.

A recalculation was made with the revised boundary conditions mentioned in the footnote on page 5 of GA-93 for Cases 1 and 6. These conditions mean physically that the angular flux distribution at the cell boundary has to be representable at the lowest possible spherical harmonics. The detailed numerical results are reproduced. (W.D.M.)

19435 IDO-16513

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

AN ANALYSIS OF A REACTIVITY TRANSIENT IN IRRADIATED THORIUM. R. G. Nisle. July 9, 1959. 23p. AT(10-1)-205. $0.75(OTS).

The irradiation of thorium in the MTR is being carried out primarily for the purpose of producing a quantity of slugs containing U^{233} for use in an exponential assembly. From time to time some of these slugs are removed in order to make reactivity measurements from which the U^{233} content may be estimated. Immediately following removal from the MTR the measured reactivity will vary with time due to the presence of U^{233} fission products, I^{135} and Xe^{135}, and due to the decay of Pa^{233} to U^{233}. The first effect is of negligible importance at the flux levels to which it is feasible to subject slugs of this size. The decay of Pa^{233}, however, produces a long-term reactivity transient of easily observable magnitude. Measurements of reactivity were made on a Savannah River type slug after irradiation for three MTR cycles at a flux level of about 2.5×10^{13} nv. Such measurements continued at intervals for a period of about 161 days. From the results it is estimated that the net production of U^{233} and Pa^{233} during the irradiation was 0.15 and 0.33 grams. The irradiation flux based on these production figures is estimated to be 1.4×10^{13} nvt. Conclusions drawn from the results are summarized as follows: (1) The change in reactivity in the slugs is due, within the accuracy of measurements, to the change in U^{233} content. Hence the U^{233} content can be determined at any time, after proper correlation with standards, by a simple reactivity measurement. (2) Because of this, thorium is suitable as a high nvt monitor when used in conjunction with RMF measurements. (auth)

19436 K-1258

Oak Ridge Gaseous Diffusion Plant, Tenn.

THE INFLUENCE OF SPECULAR REFLECTION ON THE PERMEABILITY OF POROUS MEDIA. Edwin N. Lassettre. Sept. 13, 1956. 32p. Contract W-7405-eng-26. $6.30(ph), $3.00(mf) OTS.

A review is made of some of the literature related to the specular reflection of molecular beams from crystalline solids. Having established the fact that specular reflection has been observed, the effect of such reflection on the flow of a gas through a porous bed of spheres is then considered. Solutions to the Maxwell-Boltzmann equation are obtained under a suitable set of assumptions, and it is found that the effect of specular reflection on gas transport is marked even for a bed of spheres. Equations are presented for the permeability in the cases of purely diffuse reflection, purely specular reflection and reflections both specular and diffuse. The validity of the approximations involved in obtaining the solutions is discussed. (auth)

19437 K-1310(Pt. I)

Boston Coll., Chestnut Hill, Mass.

THE INTRINSIC GEOMETRICAL AND FLOW PROPERTIES OF POWDER PACKS. (PART I). A. J. deBethune. Aug. 17, 1959. 55p. For Oak Ridge Gaseous Diffusion Plant. Contract W-7405-eng-26, Subcontracts 342 and 521. $1.50(OTS).

The experimentally measurable properties of a powder pack include the specific surface (internal pore wall surface), the porosity (internal pore volume), the Knudsen flow, and the Poiseuille flow. These four experimental data can be combined to define four independent "pore radii": the Adzumi radius calculated from the ratio of the Poiseuille flow to the Knudsen flow, the Knudsen radius from the ratio of the Knudsen flow to the porosity, the hydraulic radius from the ratio of the porosity to the specific surface, and the sigma radius from the specific surface alone. These four pore radii give a convenient characterization of the intrinsic geometrical and flow properties of any powder pack and are simply related to the flow "shape factors" μ_1 and μ_2. The four pore radii give an indication regarding the homogeneity or inhomogeneity of the pore size distribution. For homogeneous pore size distributions, the four pore radii tend to be approximately equal; for inhomogeneous pore size distributions, they become grossly unequal. In a homogeneous powder pack, the shape factors should be less than unity, to take into account the effects of irregularity, tortuosity and randomness in the pore geometry. However, powder packs whose shape factors exceed unity are not infrequent. This fact points to the effects of pore size inhomogeneities, where the larger pores contribute predominantly to the flow properties, while the surface area is determined principally by the smaller pores. This leads to a marked elevation of the flow (Adzumi and Knudsen) pore radii over the geometrical (hydraulic and sigma) pore radii, and to shape factors greater than unity. From the theory of inhomogeneous powder packs, it can be proved that, in any spectrum of observed shape factors, the lower values approximate to "intrinsic" or "normal" shape factor values. This principle leads to the envelope method for evaluating intrinsic shape factors. The four pore radii give some insight into the character of the pore size distribution. Of several distributions investigated, the double broad Gaussian appears to be the most realistic. In this bimodal distribution, the pore population is given by the superposition of two broad Gaussian terms (i.e.,

positive halves of the error functions). Equations are set up which permit the calculation, from experimental data, of the mean pore size and the pore population density of each one of the two Gaussian terms. This model can be used as a basis for testing certain other properties of powder packs: plugging function or separation factor. (auth)

19438 KAPL-M-JHS-6
Knolls Atomic Power Lab., Schenectady, N. Y.
SOME FORMULAE FOR AVERAGE SELF-SHIELDING FACTORS. J. H. Smith. June 26, 1959. 12p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

Analytic formulas are presented for desk computer calculation of average self-shielding factors for $1/v$ and resonance absorbers. Validity of the results is discussed, and a short table of some lesser known functions for calculations is included. (auth)

19439 LA-2073
Los Alamos Scientific Lab., N. Mex.
ON THE DERIVATION OF DIFFERENCE EQUATIONS FOR HYDRODYNAMICS. A. H. Taub. Aug. 27, 1956. 23p. Contract W-7405-eng-36. $4.80(ph), $2.70(mf) OTS.

Methods are presented for obtaining difference equations to represent the conservation of mass, momentum, and energy—the conservation equations which represent the motion of a fluid. The basic principle on which this work is based is that these conservation equations can be written in forms which apply whether or not discontinuities are present when the equations are written in terms of integrals. When the integrals are replaced by approximations in terms of quadrature formulas, difference equations are obtained for the relevant functions. (auth)

19440 LAMS-2282
Los Alamos Scientific Lab., N. Mex.
PRESSURE BALANCE IN A TOROIDAL PINCH. B. R. Suydam. Dec. 1958. 15p. Contract W-7405-eng-36. $3.30(ph), $2.40(mf) OTS.

In the study of a linear pinch, use of the equation of pressure balance has proven to be a powerful method of analyzing data taken with a magnetic probe. The toroidal pinch, however, is a geometrically more complicated object, and the use of the pressure balance equations is not so clean cut. The pressure balance equations for a torus are analyzed to the point where they might prove useful in interpreting probe data. (auth)

19441 NP-7737
Illinois. Univ., Urbana. Cyclotron Lab.
STATUS REPORT ON MAGNETIC FIELD PROGRAM. Technical Report No. 5. James B. Carroll and James A. McKee. Mar. 1958. 7p. Contract Nonr-1834-(05).

Investigation continued on the proposed shape of the magnetic field of the University of Illinois cyclotron and on the field measurement program. (T.R.H.)

19442 NP-7738
Illinois. Univ., Urbana. Cyclotron Lab.
MULTI-PURPOSE MAGNETIC PARTICLE ANALYZER. Technical Report No. 6. Robert L. Burman and Avivi I. Yavin. Mar. 1959. 28p. Contract Nonr-1834(05).

A mathematical treatment of the problem of using a double-focusing magnet as a spectrometer is given. (T.R.H.)

19443 NP-7760
Iowa State Coll., Ames.
OPERATING CHARACTERISTICS OF A URANIUM GRAPHITE SUBCRITICAL ASSEMBLY (thesis). Fred Hubbard Baughman. 1957. 56p.

The operating characteristics of the subcritical assembly under investigation agree quite well with the accepted theory. The 8.6 in. lattice is the optimum lattice, resulting in higher flux levels and the largest value of critical buckling. All experimental buckling determinations proved to be positive, which indicates that a full scale reactor could be constructed of the same configuration as either the 6 in., 8.5 in., or 12 in. lattice. There is no apparent measurable flux depression due to indium foil loading, even when foils are loaded unsymmetrically. Horizontal flux distributions are symmetrical in both the x and the y directions, and within the limitations imposed by statistics they agree well with the cosine distributions predicted by theory. The subcritical assembly could be operated satisfactorily using the smaller (100 millicurie) external neutron source. However, the scattering of the experimental points obtained with this source is quite severe, and statistical deviations are very large. With the larger neutron source in place, flux levels are higher by a factor of five or more, with correspondingly smaller deviations and less scattering of experimental points. The fast neutrons from the external source are not entirely thermalized until they have penetrated approximately 30 in. into the assembly. This subcritical assembly, with the large external neutron source in place, can be used to great advantage as an instructional tool. Although the experimental results obtained were not extremely accurate, it is believed that the data can be reproduced with sufficient consistency and accuracy to correlate experimental results with classroom calculations. (auth)

19444 NP-7761
Iowa State Coll., Ames.
GAMMA RAY SHIELDING PROPERTIES OF MORTARS CONTAINING SLAG (thesis). James Richard Dughi. 1957. 47p.

The results of the tests of the γ-ray shielding properties of mortars containing slag are presented. The use of slag as a fine aggregate may result in porous mortars. The shielding properties of this mortar are reduced as a result of this porosity. The use of fly ash in conjunction with slag as the fine aggregate in mortar shows an increase in the linear absorption coefficient of from 2.5 to 5%. The use of water to keep the mortars saturated resulted in an increase of from 5 to 7% regardless of the aggregate used. (W.L.H.)

19445 NP-7763
Iowa State Coll., Ames.
FEASIBILITY OF A COMPACT AXIAL FLOW NUCLEAR HEAT EXCHANGER (thesis). Charles Anthony Kiser. 1957. 63p.

Computations indicate that when utilized in an idealized ramjet at a flight Mach number of 2.5 and an altitude of 37,500 feet, a constant area axial flow nuclear heat exchanger will be expected to produce 9,500 pounds of thrust with an air inlet Mach number of 0.2, a weighted radial temperature average of 2000°F and a frontal area of 7.7 square feet. Molybdenum alloy with a disilicide coating was selected as the container material. Sandwiched between the molybdenum was a fis-

sionable alloy of highly enriched uranium and zirconium. From a nuclear aspect the unreflected heat exchanger becomes critical at a diameter of 40 inches and a length of 60 inches with a total weight of 8,052 pounds which includes 3,622 pounds of 90% enriched uranium. (auth)

19446 NP-7764
Iowa State Coll., Ames.
GAMMA RAY REFLECTION (thesis). Richard Anton Mergl. 1957. 81p.

The gamma-ray reflective properties of electrodeposited copper and zinc were investigated. The results of the experimentation are presented in tabular form. The reflected data were compared to the data obtained with no reflecting specimen in place and an analysis made on the basis of a possible shift in the peak gamma radiation, or a change in shape as the detector was rotated about the specimen. (W.L.H.)

19447 NP-7773
Padua. Università. Istituto di Fisica.
NUCLEAR RESONANCE IN CONDENSED SYSTEM AT LOW TEMPERATURES. Final Technical Report [for] May 15, 1957 to May 15, 1959. June 15, 1959. 13p. Contract DA-91-508-EUC-187.

The atomic movements in simple liquids were investigated by nuclear magnetic resonance techniques. The apparatus is described. The relaxation time of substances previously studied was measured to check the performance of the apparatus. Liquid He^3 was studied from 1.1 to 3°K under conditions of pressure saturation. The results indicated a sharp increase of T_1 decreasing the temperature below 1.4°K. (W.D.M.)

19448 NP-7774
Pennsylvania. Univ., Philadelphia.
IONS IN LIQUID HELIUM. Technical Report No. 3. K. R. Atkins. [1959]. 32p. Contract Nonr-551(28).

The mobility of an ion in liquid He^4 is known to be appreciably less than the mobility of a He^3 atom. This is explained by the suggestion that electrostriction effects increase the liquid density in the immediate vicinity of the ion so that the ion drags around with it about 50 He^4 atoms. If an almost free electron can exist in the liquid there may be an additional effect which results in a still greater effective mass. The way in which these concepts might be used to calculate the mobilities is briefly discussed. Various experimental consequences of this picture of an ion are suggested. (auth)

19449 NP-7785
Edwards High Vacuum, Ltd., Crawley, Sussex, England.
DEVELOPMENT OF ULTRA-HIGH VACUUM SYSTEMS CONTRACT CON/HAR/EMR/1094. Progress Report No. 1. B. D. Power and F. C. Robson. May 21, 1959. 8p.

A discussion of the development of trapped oil and mercury vapor pumps to have an ultimate vacuum of about 10^{-10} torr and effective pumping speed at 10^{-9} torr is given in regard to experimental pump and trap design. (C.J.G.)

19450 NP-7802
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
ROLE OF FUSION CHAIN REACTIONS IN THE NON-STATIONARY EVOLUTION OF STARS—SUPERNOVA STARS. Report No. 93/I-A. M. Gryziński. June 1959. 10p.

The hypothesis is suggested that the cause of the explosion of supernova stars is the development of a fusion chain reaction in stellar material containing a large amount of He^3 at high densities ($\sim 2 \times 10^4$ g/cc). It is suggested that the conditions suitable to a strong concentration of He^3 exist only for relatively small hydrogen stars. The strength of the explosion is proportional to the amount of He^3 amassed which strongly depends on the mass of the star. The proto-stars with masses smaller than the mass of the sun lead to supernovae of type I and the proto-stars with masses equal or greater than the mass of the sun lead to supernovae of type II. The remnant of a supernova of type I is the gaseous nebula of luminosity due to the decay of Be^7 created during the explosion in the reaction $He^4(He^3,\gamma)Be^7$. (auth)

19451 NP-7804
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
EQUIPMENT FOR PRELIMINARY FRACTIONAL DISTILLATION OF SPECTROGRAPHIC SAMPLES. Report No. 88/VIII. L. Pszonicki. May 1959. 18p.

An apparatus is described for the preliminary fractional distillation of spectrographic samples. Electric resistance heating is used, and the graphite crucible containing the sample serves as the heating element. Temperature measurements are carried out with the aid of a built-in photocell. The vapors of contaminations condense directly on the spectrograph electrode subsequently used for determination. Distillation is carried out in air. The use of preliminary fractional distillation in spectrographic determinations lowers the detection limit for numerous elements by one to three orders of magnitude. (auth)

19452 NP-7806
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
MAGNETOHYDRODYNAMICAL WAVES IN WAVE GUIDES. Report No. 86/VII. R. Gajewski. May 1959. 23p.

Propagation of magnetohydrodynamical waves in bounded fluids is investigated. The boundary of the fluid is assumed to be a cylindrical surface of constant but not necessarily circular cross section. It is assumed that the medium is a perfect fluid and at the same time a perfect conductor, and that a constant magnetic field is applied parallel to the walls of the cylinder. It is shown that inside of such a wave guide the following types of waves can propagate: (1) transversal waves propagating without dispersion with the velocity of Alfvén waves; (2) longitudinal wave, identical with the wave of the principal mode for an acoustic wave guide; (3) waves having both longitudinal and transversal components, and propagating with a dispersion, their group and phase velocity being close to respective velocities for an acoustic wave guide; (4) waves having both longitudinal and transversal components, and propagating with a small dispersion, their group and phase velocity being close to the velocity of Alfvén waves. Damping of certain modes, if applied frequency is too low, appears only for waves of the type (3); the cut-off frequencies turn out to be slightly higher than the corresponding cut-off frequencies for an acoustic wave guide. (auth)

19453 NP-7817
Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
CANONICAL FORMS FOR INFORMATION-LOSSLESS

FINITE-STATE LOGICAL MACHINES. Technical Report No. 349. David A. Huffman. Mar. 25, 1959. 21p. DA Project 3-99-00-100. Contract DA36-039-sc-78108.

An important class of finite-state machines transforms input sequences of digits into output sequences in a way such that, after an experiment of any finite length on the machine, its input sequence may be deduced from a knowledge of the corresponding output sequence, its initial and final states, and the set of specifications for the transformations by which the machine produces output sequences from input sequences. These machines are called "information-lossless." Canonical circuit forms are shown into which any information-lossless machines may be synthesized. The existence of inverses for these circuits is investigated and circuits for their realization are derived. (auth)

19454 NP-7824

Columbia Univ., New York. Columbia Radiation Lab.

RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 6 [for] March 16, 1959 through June 15, 1959. June 15, 1959. 36p. Contract DA-36-039 SC-73279.

Work on several maser projects is reported. These include solid state masers at 3 cm and at 21 cm, a solid state maser to operate at liquid nitrogen temperatures instead of liquid helium temperatures and an infrared maser. The application of maser techniques to radioastronomic measurements and to high resolution spectroscopy of molecules is discussed. Studies of various materials, directed towards an elucidation of the properties of these materials for potential maser application are described. Continuing work on magnetron development and on the generation of Cherenkov radiation is reported. Experiments directed towards determining hyperfine structure measurements in various atoms are described. Finally the results of a continuing interest in the properties of the metastable state of hydrogen are described and a new experiment is proposed to determine the lifetime of the metastable state of singly ionized helium, a hydrogenic atom. (For preceding period see NP-7572.) (auth)

19455 NRL-Memo-940

Naval Research Lab., Washington, D. C.

STATUS REPORT ON THERMOELECTRICITY. H. E. Stauss. June 1959. 56p.

The power-to-weight ratio of several thermoelectric generators is considered. Also, the characteristics of thermoelements cooled by radiation are examined and the role of temperature in thermoelectricity is discussed. A review of the government's interest in thermoelectricity and thermoelectric devices is given, and changes in contracts are listed. Materials data on Bi_2Se_3 and Sb_2Te_3 are included. (J.R.D.)

19456 NYO-2542

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.

QUASI-TRIDIAGONAL MATRICES AND TYPE-INSENSITIVE DIFFERENCE EQUATIONS. Samuel Schechter. May 1, 1959. 25p. $4.80(ph), $2.70(mf) OTS.

Direct methods are proposed to solve $Qv = g$ where Q is a quasi-tridiagonal matrix. Such matrices arise in solving finite difference equations of problems for pure elliptic equations and for the symmetric positive systems of K. O. Friedrichs. An example is given of the latter type for solving a boundary problem for the Tricomi equation. The methods employ a partitioned decomposition of Q into a product of lower and upper triangular matrices and a criterion is given for the methods to apply. Direct methods seem especially useful where iterative methods are found not feasible. Other methods for special types of Q are proposed which involve the inversion of relatively small matrices. (auth)

19457 NYO-2616

Westinghouse Electric Corp. Research Labs., Pittsburgh.

ULTRAHIGH VACUUM TECHNIQUES. Quarterly Progress Report for April 1, 1959–June 30, 1959. Research Report 403FF66-R2. July 28, 1959. 19p. Contract AT(30-1)-2176. $3.30(ph), $2.40(mf) OTS.

The tests on the usefulness of Teflon for ultrahigh vacuum purposes were continued. Additional studies were made on the use of zeolite and similar materials for large conductance, non-refrigerated isolation traps. A further investigation of the system involving hydrogen and hot tungsten was made employing a photomultiplier ion gage to measure pressure changes. (For preceding period see NYO-2615.) (W.L.H.)

19458 OOR-2013:1

Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.

MEASUREMENT AND CHARACTERIZATION OF TURBULENT MIXING (thesis). Interim Technical Report No. 1 [for] December 18, 1957 to May 18, 1959. Ronald E. Rosensweig. May 18, 1959. 211p. DA Project No. 599-01-004. Contract DA-19-020-ORD-4549.

A smoke-scattered light technique was developed for measurement of the concentration fluctuation in the mixing region of two isothermal gaseous streams. Measurements obtained for statistical properties characterizing the concentration fluctuations included the intensity, the scale, and the spectral distribution. The results agree with comparable temperature fluctuation data reported in the literature. Another flow system was studied with the object of measuring the state of mixedness within a chamber under conditions simulating cold flow in a combustor. (auth)

19459 OOR-2207:3

Illinois, Univ., Urbana.

ON POSITIVE REAL FUNCTIONS (thesis). Interim Technical Report No. 14. Jack Leonard Goldberg. Mar. 27, 1959. 59p. DA Project No. TB2-0001. Contract DA-11-022-ORD-1983.

Functions which map the right half-plane into itself and which take reals into reals are considered. The notion of a "positive real" function is defined. Some new results which generalize theorems of Brune and Seshu and Balabanian are included. For an arbitrary positive real function a sequence of rational positive real functions which interpolate the given function on an assigned set of positive numbers is constructed so as to converge uniformly to the given function on any compact subset of the right half-plane. It is then possible to generalize the theorems obtained, and to provide the set of necessary and sufficient conditions that there exists a positive real function that assumes the values $w_0, w_1 \ldots w_i \ldots$ at the points $a_0, a_1 \ldots a_i \ldots$ where $a_i > 0$. (auth)

19460 ORNL-2754

Oak Ridge National Lab., Tenn.

BREMSSTRAHLUNG SPECTRA IN AN INFINITE SO-

DIUM IODIDE CRYSTAL. C. D. Zerby and H. S. Moran. Aug. 18, 1959. 16p. Contract W-7405-eng-26. $0.50 (OTS).

The calculated average bremsstrahlung spectra resulting from one collision of a source photon in an infinite sodium iodide crystal are presented in graphical form. The data presented include source photon energies from 0.1 to 20 m_0c^2. (auth)

19461 SC-4342(M)
[Sandia Corp., Albuquerque, N. Mex.].
PAPER TAPE FORMAT COMPATIBLE WITH EXISTING IBM 705 ROUTINES. Aug. 1959. 19p. $1.80(ph), $1.80(mf) OTS.

In defining the format for data punched on paper tape, consideration must be given to the conversion from paper to magnetic tape and to the final form of the magnetic tape file. The problem of converting data on paper tape to the magnetic tape masterfile format involves three types of data; identifying information, attribute data, and test data. Identification information in relation to various code records is explained. (C.J.G.)

19462 SCR-98
Sandia Corp., Albuquerque, N. Mex.
GENERALIZED FUNCTIONS OF GREEN FOR SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS. Oswald Wyler. July 1959. 24p. Contract [AT(29-1)-789]. $0.75(OTS).

The adjoint operator of a matrix operator and adjoint boundary conditions for adjoint matrix operators are defined. It is shown that a matrix operator can be associated in various ways with a scalar differential operator and if two adjoint matrix operators are associated with scalar differential operators then the scalar operators are adjoint. Generalized Green's functions are obtained and their use for solving boundary-value problems is discussed. Properties which characterize a generalized function of Green are obtained and it is shown that the generalized functions of Green of adjoint boundary-value problems are adjoint kernel matrices. Generalized Green's functions for scalar boundary-value problems are discussed and special cases taken up. (C.J.G.)

19463 SCR-102
Wisconsin. Univ., Madison.
INFORMATION, COMMUNICATION, AND LANGUAGE. Preston C. Hammer. July 1959. 14p. $0.50(OTS).

A lecture delivered at Sandia Corp., Albuquerque, N. Mex., June 18, 1958.

A discussion of information exchange theory is presented. Semantics in communication are examined, and the use of symbols in thinking and presentation are discussed in some detail. (J.R.D.)

19464 SCR-103
Sandia Corp., Albuquerque, N. Mex.
QUADRATURE FORMULAS INVOLVING DERIVATIVES OF THE INTEGRAND. Preston C. Hammer and Howard H. Wicke. July 1959. 13p. Contracts [AT(29-1)-789] and DA-11-022-ORD-2301. $3.30(ph), $2.40 (mf) OTS.

The existence of quadrature formulas involving derivatives of the integrand was demonstrated. One such formula is, for k an odd positive integer,

$$\int_{-1}^{1} f(x)dx = 2 \sum_{i=0}^{(k-1)/2} \frac{f^{(2i)}(0)}{(2i+1)!} + \sum_{j=1}^{m} a_j\left[f^{(k)}(x_j) - f^{(k)}(-x_j)\right] + R_{m,k}(f).$$

The theory of orthogonal polynomials is used to establish these formulas and provide both recurrence formulas for the polynomials and an expression for the remainder. The weight functions involved in the proof appear to be different from those treated heretofore in the literature. (auth)

19465 SCR-104
Illinois. Univ., Urbana.
SOME MICROWAVE STUDIES OF GASEOUS PLASMAS. L. Goldstein. July 1959. 32p. $1.00(OTS).

A Lecture Delivered at Sandia Corp., Albuquerque, N. Mex., April 8, 1959.

The type and nature of plasmas considered are defined, and it is shown that significant results are quite general and can be applied to large classes of plasmas. The physical phenomena are emphasized at the expense of the mathematics. (W.D.M.)

19466 SCS-R-149
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE SPECTROGRAPHIC DETERMINATION OF BORON IN CAST URANIUM METAL BY THE CARRIER-DISTILLATION TECHNIQUE. R. Franklin and A. L. Wilson. Mar. 23, 1953. 12p.

An investigation into the possibility of determining trace amounts of boron in cast uranium metal has been carried out. The carrier distillation method has been modified by the use of an increased charge of U_3O_8 (250 mg) and the employment of ammonium fluoride as the carrier compound. This has resulted in a sensitivity of 0.01 parts per million of boron in uranium as against the limit of 0.1 parts per million obtained by the normal carrier distillation method. The spectra are evaluated by means of a cathode ray microphotometer or a non-recording microphotometer depending on the concentration of boron in the sample. Chemically analyzed samples are used for standardization. (auth)

19467 SCTM-52-59(51)
Sandia Corp., [Albuquerque, N. Mex.].
THE CONSTRUCTION OF GEOTHERMAL STEAM POWER PLANTS UTILIZING NUCLEAR EXPLOSIVES. Roland H. Carlson. June 5, 1959. 31p. [Contract AT(29-1)-789]. $4.80(ph), $2.70(mf) OTS.

An investigation was made of the feasibility of using nuclear explosives in the construction of geothermal steam power plants. Geothermal steam plants now in operation, proposed geothermal projects, areas of possible exploitation, and possible methods whereby nuclear explosives may be employed are discussed. Economic advantages of nuclear applications are indicated. It is concluded that realistic applications of nuclear explosives to geothermal power-plant construction do exist. (auth)

19468 SCTM-122-55(12)
Sandia Corp., Albuquerque, N. Mex.
WATER IMPACT LOADS ON A SEMIBLUNT-NOSED CYLINDRICAL BODY. Paul M. Knox, Jr. June 22, 1955. 18p. $3.30(ph), $2.40(mf) OTS.

A study was made to develop a reliable approximate method for estimating the water impact load on a semiblunt-nosed cylindrical body resulting from drops at various altitudes and velocities. (auth)

19469 SCTM-179-59(51)
Sandia Corp., Albuquerque, N. Mex.
A SURVEY OF THE LITERATURE ON INELASTIC COLLISIONS OF ELECTRONS AND HYDROGEN IONS WITH HYDROGEN MOLECULES. G. W. McClure. May 13, 1959. 20p. $0.75(OTS).

The available cross section data on the electronic processes resulting from single collisions of electrons, H_2^+, H^+, H^- ions and H atoms with hydrogen gas molecules are graphically summarized. Only those processes which result in a change of species of the primary particle or gas molecule are considered. These include electron capture and loss by the primary ions, dissociation of primary molecular ions and ionization and dissociation of gas molecules by the primary particles. The range of energies of the primaries is 10 to 10^6 ev. (auth)

19470 SCTM-241-55(51)
Sandia Corp., Albuquerque, N. Mex.
UNIDIRECTIONAL FLOWS IN ONE-DIMENSIONAL MAGNETO-HYDRODYNAMICS. S. Bell. Nov. 29, 1955. 11p. $3.30(ph), $2.40(mf) OTS.

A conducting fluid in the presence of an electromagnetic field is characterized by the equations of magnetohydrodynamics. It is assumed that all quantities are constant in any plane perpendicular to the direction of fluid flow, and the simple wave technique is used to find solutions for a compressible, inviscid fluid with finite conductivity. The problem reduces to one of solving a simple system of first order ordinary differential equations, and for a special case, an explicit solution is exhibited. (auth)

19471 SCTM-267-59(14)
Sandia Corp., Albuquerque, N. Mex.
CALCULATION OF THE IMPEDANCE OF A CYLINDRICAL ANTENNA IN AN IONIZED MEDIUM OF LOW ATTENUATION FACTOR BY MEANS OF TABLES OF THE EXPONENTIAL INTEGRAL FOR COMPLEX ARGUMENTS. Charles W. Harrison, Jr. Aug. 2, 1959. 12p. $3.30(ph), $2.40(mf) OTS.

A simple procedure is presented for calculating approximately the impedance of a relatively thin dipole immersed in an infinite dissipative medium of low attenuation using available tables of the exponential integral for complex arguments. (auth)

19472 WADC-TR-59-189(I)
Plasmadyne Corp., Santa Ana, Calif.
A PRELIMINARY ENGINEERING EVALUATION OF ADVANCED SPACE PROPULSION SYSTEMS. VOLUME I. GENERALIZED PROPULSION SYSTEM ANALYSIS AND MISSION REQUIREMENTS. Paul S. Masser, Russell J. Page, and Willis Stoner. Mar. 25, 1959. 64p. Project No. 3058. Contract AF33(616)-5709. (P-1FR039-5709).

A generalized propulsion system analysis relates the "optimum" specific impulse to (1) the mission characteristic velocity, (2) available propulsion time, and (3) the ratio of power source weight to jet power, for the cases of one, three, and an infinite number of round trips. The optimum specific impulse is found to be mainly set by the ratio of propulsion time to power source specific weight with less effect caused by changes in characteristic velocity. The analysis includes "off-optimum" specific impulse performance. A unique method of presenting the results which is particularly adapted to superposition of mission requirements was devised. Representative requirements were determined for several satellite, one Moon, and one Mars missions to indicate propulsion system choice. Emphasis was placed on insuring the accuracy of comparison of different propulsion systems. (auth)

19473 WAPD-T-950
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
FACTORIZATION AND NORMALIZED ITERATIVE METHODS. Richard S. Varga. Apr. 1959. 35p. Contract AT-11-1-GEN-14. $6.30(ph), $3.00(mf) OTS.

Paper presented at the Symposium on Boundary Problems in Differential Equations at the University of Wisconsin, Madison, April 21, 1959.

Iterative methods are described which depend on the direct solution of matrix equations involving matrices more general than the tridiagonal type. Solution methods for these approximate equations are given, and standard methods for accelerating convergence applications are described. (J.R.D.)

19474 WAPD-T-962
Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.
RESONANCE ESCAPE PROBABILITY CALCULATIONS IN NONUNIFORM LATTICE ARRAYS. R. S. Wick. Apr. 1959. 23p. Contract AT-11-1-GEN-14. $4.80(ph), $2.70(mf) OTS.

In actual reactors employing uranium in the form of plates it is necessary to use additional structural support material which leads to a nonuniform lattice array of subassemblies or clusters. The thin resonance theory of Stein for an infinite array of fuel plates moderated by water was extended to handle nonuniform arrays of fuel plates, or for that matter any resonance absorber including control rods, typical of that likely to be found in an actual reactor. (W.D.M.)

19475 WAPD-TM-28(Add.2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
WANDA—A ONE-DIMENSIONAL FEW-GROUP DIFFUSION EQUATION CODE FOR THE IBM-704. O. J. Marlowe. July 1959. 25p. Contract AT-11-1-GEN-14. $1.00(OTS).

WANDA-4 represents a further improvement in the WANDA series of IBM-704 computer codes which provide numerical solutions of the one-dimensional few-group diffusion equations. The input and output sections are refined and the use of magnetic drum storage is eliminated. The code now requires a computer with at least 8192 words of core storage, one to four tape units, and an on-line printer; in addition, the code may use an on-line card reader and an on-line punch, as well as the peripheral tape-to-printer and card-to-tape equipment. Larger problems are permitted if additional core storage is available. (auth)

19476 WAPD-TM-174
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SET CODES—IBM 704 CODES FOR THE CALCULATION OF THE STRESSES IN A PRESSURE VESSEL WITH AN ELLIPSOIDAL HEAD. G. G. Bilodeau, J. B. Callaghan, and H. Kraus. June 1959. 29p. Contract AT-11-1-GEN-14. $1.00(OTS).

A solution to the problem of stresses in a pressure vessel with an ellipsoidal head has long been sought by pressure vessel designers. To meet this need the codes described in this report were written. The codes are based on a finite-difference approximation to the Love-Meissner equations which are the basis of the bending theory of thin shells. (auth)

19477 ZPH-030
Convair, San Diego, Calif.
SEMI-ANNUAL PROGRESS REPORT. No. 4. Apr. 30, 1959. 391p.

Detailed research analyses, research abstracts and summaries, and brief preliminary studies of future research programs are presented. The main effort of the Nuclear Physics group was directed toward the meas-

urement of neutron cross sections. Additional work on radiation was started and preliminary results are reported. The Solid State Physics group was primarily concerned with the interaction between atomic particles or radiation and solid surfaces. Some work pertaining to advanced interceptors, such as sintering and vacuum friction, was started. The work in the Plasma Physics group continued to emphasize electrohydrodynamics. Included in the work of the Upper Atmosphere Physics group is a combined experimental and theoretical program to study the interaction of microwaves with hypersonic flow fields. The Molecular Physics group was largely concerned with the thermodynamics and physical properties of high-temperature gases. The Applied Mathematics group initiated a number of flow field studies applicable in various mediums from under water to outer space. The activities of the Physical Mechanics group included plasma studies, shock tube research, heat-transfer research, ablation studies, sea water conversion, and nuclear propulsion. (For preceding period see ZPH-020.) (W.D.M.)

19478 AEC-tr-3676
WEAK AND STRONG SYSTEMS OF A DISCHARGE IN GASES. (Regimes Faible et Fort D'une Decharge Dans Les Gaz.) I. Podliasky. Translated for Oak Ridge National Lab. from CEA Report IP-14-IP/GC. 10p. (Includes original, 5p.). $1.80(ph), $1.80(mf) JCL.

Two extreme methods of movement of an electrified particle belonging to a cylindrical plasma contained between two parallel metallic armatures are examined. The "mobility" of a particle in a weak system is defined by a differential equation having a permanent solution; no permanent solution was found for a strong system. (C.J.G.)

19479 AEC-tr-3724
THERMOELECTRIC PROPERTIES OF THE NOBLE METALS AND THEIR ALLOYS. (Termoelektricheskie Svoistva Blagorodnykh metallov i ikh Spavov.) Aleksandr Alekseevich Rudnitskii. Translated from a publication of the Publishing House of the Academy of Sciences, U.S.S.R., Moscow, 1956. 238p. $2.50(OTS).

Thermoelectric effects are thermodynamic functions of current carriers. These effects were investigated by measuring the integral thermal emf and by the use of various comparison methods. Differential thermal electromotive forces were measured with the aid of potentiometers and pyrometers. Results were compared with those obtained using a Pt electrode having known thermoelectric properties. Reliable values for the thermal emf of Au, Ag, Pt, Pd, Rh, Fe, Co, and Ni were obtained. Purity determinations were made and it is shown that thermal emf is sensitive to impurities in Pt and Pd. The analysis method is applicable to Au–Ag, Pt–Pd, Pd–Au, Pd–Ag, Pt–Au, Pt–Ag, Pt–Rh, Pd–Cu, and Pt–Cu alloys. Detailed procedures are included, and several conclusions are listed and discussed. Results are tabulated and presented graphically. (J.R.D.)

19480 AEC-tr-3745
ON THE APPEARANCE OF JETS IN CARBON ARCS OF A HIGH CURRENT INTENSITY. [PART] II.
R. Wienecke. Translated for Oak Ridge National Lab. from Z. Physik 151, 159-73(1958). 37p. (Includes original, 15p.). $4.80(ph), $2.70(mf) JCL.

By repulsion measurements on the cathode it is proved that the acceleration of vapor jets occurring in carbon arcs of high current intensities is caused primarily by changes in density during sublimation of the cathode material. Estimations of the vapor jet velocity from repulsion measurements and consumption measurements result in values of about 10 km/sec directly above the cathode, which corresponds approximately to twice the velocity of sound. By means of a current impulse method the velocity in the arc axis from the anode up to a distance of 1 cm to the cathode is measured directly from slow-motion pictures; at closer distances to the cathode it is measured from the occurring Mach-angle with an externally applied interference. Extrapolation of the measured velocity curve on the cathode surface confirms the stated interpretation. (auth)

19481 AEC-tr-3755
STRUCTURE OF ABSORPTION SPECTRUM OF KCl AND NaCl CONTAINING TRACES OF AgCl. Ruzena Bubakova. Translated by Lydia Venters (Argonne National Lab.) from Czechoslov. J. Phys. 7, 110-11(1957). 6p. $1.80(ph), $1.80(mf) JCL or LC.

Absorption of single crystals which were separated from pure fused KCl and NaCl and contaminated by the diffusion of Ag ions was measured. After heat treatment the concentration of Ag ions was not uniform. The KCl crystals become colored in K vapor while the NaCl crystals are colored in Na vapor. It is noted that Ag colloids formed due to the heating of colored crystals have properties similar to those of thin Ag layers evaporated from Si. Observations of Ag colloids in KCl and NaCl–AgCl single crystals show that colloids form in boundary planes of crystalline blocks. (J.R.D.)

19482 AEC-tr-3757
MAGNETOCALORIC EFFECT IN URANIUM HYDRIDE AND DEUTERIDE. A. I. Karchevskii. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Eksptl.' i Teoret. Fiz. 36, 638-9(1959). 5p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 10256.

19483 AEC-tr-3758
ISOTOPIC SHIFT OF CURIE POINT IN URANIUM HYDRIDE AND DEUTERIDE. A. I. Karchevskii, E. V. Artiushkov, and L. I. Kikoin. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Eksptl'. i Teoret. Fiz. 36, 636-7(1959). 4p. $1.80(ph), $1.80(mf) JCL and LC.

The residual magnetization of samples of UH_3 and UD_3 were measured with an astatic magnetometer at temperatures near the curie point. Isotopic shift of the curie temperature in the transition from UH_3 to UD_3 was observed in all cases. The shift did not depend on purity. The shift = + (4.0 ± 0.5)°K. (T.R.H.)

19484 AEC-tr-3760
HEAT TRANSFER IN TURBULENT MOTION OF LIQUID IN TUBES. M. A. Mikheyev. Translated by Lydia Venters (Argonne National Lab.) from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, 1448-54(1952). 11p. $3.30(ph), $2.40(mf) JCL or LC.

A new equation for heat transfer in straight tubes containing turbulent liquids was evolved. Reliable experimental data for various liquids and gases under varied conditions were used for the generalization. (J.R.D.)

19485 AEC-tr-3761
A NUCLEAR RESONANCE SPECTROGRAPH WITH HIGH RESOLUTION. PART I. THEORY OF LINE DE-

FORMATION IN THE HIGH RESOLUTION NUCLEAR RESONANCE SPECTROSCOPY. H. Primas. Translated for Los Alamos Scientific Lab. from Helv. Phys. Acta 30, 297-315(1957). 18p. $3.30(ph), $2.40(mf).

The deformation of nuclear resonance signals due to non-homogeneous magnetic fields (quadratic field and spatially stochastic field) and to stochastically time-fluctuating magnetic fields, are discussed. The permissible fluctuations of the magnetic fields for a specified resolution are indicated and the question as to what measuring techniques are suitable for least distortion of signals is examined. (auth)

19486 CEA-tr-A-451

SOURCES D'IONS POUR DES RECHERCHES DE PHYSIQUE NUCLÉAIRE. (Ion Sources for Nuclear Physics Research.) O. Reifenschweiler. Translated into French by R. Caboz from Elektrotech. u. Maschinenbau 74, No. 5, 96-103(1957). 41p.

A review is presented on the operation and properties of ion sources. The principle of operation of ion sources is first discussed. Then the most important types of sources are described. The types are divided into two groups, those for which the extraction and production of ions is a simultaneous process and those for which the two processes are separated in time. From the first group, canal-ray tubes and Penning ion sources are described. Ion sources with extractive probes are included in the second group and are described. Among these are high-frequency ion sources, low voltage arc and capillary arc ion sources, and arc and magnetic field ion sources. The electron collision ion source, also in the second group, is described. 16 references. (J.S.R.)

19487 CEA-tr-A-570

SUR LA PROPAGATION DES ONDES DANS UN TUBE À PLASMA AVEC CHAMP MAGNÉTIQUE EXTÉRIEUR. (The Propagation of Waves in a Plasma Tube with Exterior Magnetic Field.) Georg Bittner. Translated into French from Z. angew. Phys. 10, 117-22(1958). 22p.

The propagation of waves in a plasma tube with exterior magnetic field was studied. The experimental method and apparatus were described. Three regions of propagation were distinguished. In the first region $\omega \ll \omega_1 = \omega_0/\sqrt{2}$ where ω is the imposed frequency, ω_1 is the boundary frequency without magnetic field, and ω_0 is the characteristic frequency of the plasma. The phase velocity is a little less than the light velocity. The damping approaches a value α less than 10 free neutrons per cm. The exterior magnetic field has no effect on the propagation constants, and the arithmetic mean of the wave impedance is 225 ohms. In the second region ω approaches ω_1 and ω approaches ω_2, the boundary frequency with increasing magnetic field. The phase velocity in the vicinity of the frequencies ω_1 or ω_2 falls rapidly toward zero, and the damping increases rapidly. Slight variations in discharge current or imposed frequency cause large variations in the phase velocity and the damping. In the third region $\omega_2 < \omega < \omega_c$ $2\pi c/1.71D$ where ω_c is the critical frequency of the hollow conductor. The phase velocity is unmeasurable. The damping has an almost constant value at 1 free neutron per cm. (tr-auth)

19488 CTS-517

THE PHYSICS OF SUPER-HIGH PRESSURE. (Fizika Sverkhvysokikh Davlenii.) L. F. Vereshchagin. Translated for Dept. of Scientific and Industrial Research, London from Priroda 46, No. 6, 3-8(1957). 15p. Price £1.16s. (United Kingdom) £2.8s. (Overseas) DSIR.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10589.

19489 SCL-T-259

ELECTRON EMISSION OF METAL SURFACES AS AN AFTER-EFFECT OF A MECHANICAL TREATMENT OR A GLOW DISCHARGE. (Die Elektronenemission von Metalloberflächen als Nachwirkung einer mechanischen Bearbeitung oder Glimmentladung.) O. Haxel, F. G. Houtermans, and K. Seeger. Translated by Marcel I. Weinreich (Sandia Corp.) from Z. Physik 130, 109-23(1951). 21p. $4.80(ph), $2.70(mf) JCL.

If a metal surface is emory-polished or if it is exposed to a glow discharge, then an electron emission occurs which fades away with time. Measurements showed that the product of emission current and emission time is constant. The temperature dependence of the electron emission was examined. The electron emission is interpreted as an accompanying or secondary phenomenon of a chemical adsorption process on the metal surface. The experiments make it possible to derive the activation energies of that adsorption process. A detailed theory of such a chemical adsorption process is advanced, and its inferences are compared with the measuring results. (auth)

19490 SCL-T-261

CONCERNING NORMAL LINEAR CORRELATIONS OF VECTORS. (O Normal'noi Lineinoi Korrel'atsii Vektorov.) Yu. A. Shishkov. Translated by Marcel I. Weinreich (Sandia Corp.) from Meteorol. i Gidrol., No. 6, 55-8(1958). 11p. $3.30(ph), $2.40(mf) JCL or LC.

It is not always possible to express vector connection analytically because of a great number of factors that do not submit to calculation. Theory of the linear correlation of vectors is developed for the practitioner who is acquainted only with the elements of mathematical statistics and of the tensor computation, thus providing him with a scheme of correlation. It may be successfully applied by hydrometeorologists with the use of electronic computers. (W.D.M.)

19491 SCL-T-270

SURFACE INVESTIGATION ON METALS AND NON-METALS WITH EXO- AND PHOTOELECTRONS. (Oberflächenuntersuchung an Metallen und Nichtmetallen mit Exo- und Photoelektronen.) J. Kramer. Translated by Marcel I. Weinreich (Sandia Corp.) from Z. Physik 133, 629-46(1952). 27p. $4.80(ph), $2.70(mf) JCL.

After certain treatments, a metal surface will emit spontaneously a number of electrons which are called "exoelectrons." Under the same conditions, the short-wave boundary in the photoeffect is also shifted toward the longer waves. The method of investigating surfaces with the needle counter can be rendered more sensitive by building in sources of light which are suited to the objects which happen to be under study. It is possible to follow treatment processes, the influence of expansion and tearing, as well as other contacts. In the case of non-metals, the same effects can be brought about not only by a mechanical treatment but also by a suitable radiation, whereby the short-wave boundary is shifted up to and into the ultrared range. The fading of the exoelectrons and of the shifting of the short-wave boundary after mechanical treatment and radiation is

examined, and the latent pattern is demonstrated with the aid of exo- and photoelectrons. The excited states caused by radiation can be expanded into a spectrum by thermal analysis; and for each excited state it is possible to determine the formation energy as well as the activation energy required for the extinction or evanescence. (auth)

19492 TT-817

THE DEVELOPMENT AND SIGNIFICANCE OF THE RÖNTGEN AS A DOSE UNIT. (Zur Entwicklung und Bedeutung der Dosiseinheit "Röntgen.") R. G. Jaeger. Translated by D. A. Sinclair (National Research Council of Canada) from Strahlentherapie 108, 8-16(1959). 14p.

A clear separation of quantities and units used in defining radiological concepts, especially the dosimetric ones, is needed in order to fit these quantities and units of medical radiation measuring technique into the international system of physical definitions and to base the units on the elementary physical units. An attempt was made to show that this affords the advantage for practical dosimetry that the fundamental ionization method can be applied in a clear way not only to x rays and gamma rays of any energy range but also to corpuscular radiations with the exception of neutrons. Clear relationships between the measured ionization dose and the energy dose (absorbed dose) were derived. Supplementing the work of Fränz, Hübner, and Jaeger, the suggested definitions, formulas, dimensions, and units of radiation energy, radiation rate, energy dose (absorbed dose), ionization dose, dose rate, integral dose, surface energy, and irradiation strength have been tabulated in as clear a manner as possible. (auth)

19493

OSCILLOGRAPHIC MEASUREMENTS ON HIGH CURRENT SPARKS. Berthold Kühn (Vereinigtes Institut für Kernforschung, Z. Z. Dubna/Moscow). Ann. Physik 3, 241-59(1959). (In German)

Measurements of high accuracy on the voltage, current, resistance, and power in high-current sparks were made with an accurate measurement apparatus. The energy balance of the spark was determined, an estimation of the temperature in the spark plasma was made, and a review of the relationship $\sigma = u \times a/p$ from the Weizel and Rompe theory was undertaken. From the experimental data conclusions on the formation of the spark track were drawn. (tr-auth)

19494

THE EVALUATION OF LATERAL OBSERVATIONS ON CYLINDRICAL ARCS. J. Friedrich (Osram-Studiengesellschaft für elektrische Beleuchtung, Berlin). Ann. Physik 3, 327-33(1959). (In German)

A simple, but accurate, approximation method for the evaluation of lateral observations of cylindrical arcs was derived by conversion of an integral equation of the Abel type. The radial dependence of the radiation per unit of volume can be determined easily from the observed light density distribution of a cylindrical high-pressure discharge. As an example, a liquid-cooled, wall-stabilized xenon high-pressure discharge was investigated. (tr-auth)

19495

INSTATIONARY PROCESSES IN SOLAR-FLARES AS EXPRESSIONS OF THE PINCH-EFFECT. A. B. Severny. Astron. Zhur. 35, No. 3, 335-50(1958).

A theoretical discussion and evaluation of the results of observations of solar flares are presented. The spectra of strong flares and tendrils, the occurrence of flares at neutral points of the magnetic field, and flares as expressions of the pinch effect and collisions of shock waves are discussed. The hard emission of the flares is also considered. 21 references. (J.S.R.)

19496

THE PHYSICAL NATURE OF NONTHERMAL ULTRAVIOLET EMISSION IN THE SPECTRA OF T TAU STARS AND THE ORIGIN OF COSMIC RAYS. I. I. M. Gordon. Astron. Zhur. 35, No. 3, 458-68(1958).

The non-thermal ultraviolet radiation of T tau stars can be interpreted by the theory of the excitation of emission lines in the atmospheres of non-stationary stars by synchrotron radiation of relativistic electrons. It is assumed that ultraviolet emission in the region $\lambda < 3800$ A is a confluence of higher members of the Balmer series which merge into a Balmer continuum, emission arises in a small part of the stellar atmosphere, the high density of non-thermal radiation leads to the predominance of induced transitions and to broadening and merging of the higher members of the Balmer series, and the polarization of the Balmer lines and the Balmer continuum is caused by the linear polarization of the synchrotron radiation which causes induced transitions. The spectrum of synchrotron radiation in a broad interval satisfies the expression corresponding to the energy expression of relativistic particles. The total energy of relativistic electrons generated is more than the total thermal radiation of the star. (J.S.R.)

19497

AN OBSERVATIONAL TEST OF THE CARBON-CYCLE RATE. Donald C. Morton (Princeton Univ., N. J.). Astrophys. J. 129, 20-5(1959) Jan.

If there exists a low-energy resonance in the $N^{14}(p,\gamma)O^{15}$ reaction, the rate of the carbon cycle is faster by a factor of about 100 than without such a resonance. To test the existence of the resonance, the luminosities and effective temperatures of theoretical models for unevolved stars using the two different reaction rates are compared with the observed initial main sequence in the Hertzsprung-Russell diagram. Although there are large uncertainties in the comparison, the results distinctly favor no resonance over resonance. (auth)

19498

MAGNETOHYDRODYNAMIC DISTRUBANCES DUE TO THE SUDDEN INTRODUCTION OF A MAGNETIC DIPOLE IN A FLUID OF FINITE CONDUCTIVITY. M. G. S. El Mohandis (King's College, Newcastle, Upon Tyne, Eng.). Astrophys. J. 129, 172-93(1959) Jan.

Mathematical solutions for the magnetohydrodynamic perturbations are given for the case of a magnetic dipole placed either parallel or perpendicular to the exciting field in an infinite fluid of finite electrical conductivity. Walén's (1944) approximation is used, and charts representing the excited field, the total field, and fluid motion are drawn. (auth)

19499

LONG-RANGE INTERACTIONS IN IONIZED GASES IN THERMAL EQUILIBRIUM. F. D. Kahn (Princeton Univ., N. J.). Astrophys. J. 129, 205-16(1959) Jan.

Collective long-range interactions affect the distribution of the charged particles belonging to a plasma in

thermal equilibrium. The charge density can be expressed in terms of spatial Fourier components; when this is done, it is found that at a finite temperature the components of low wave number k have an amplitude proportional to k^2, while in a random distribution the amplitude is independent of k. The components of large wave number remain unaffected, the critical wave number being of the order $(4\pi\Sigma\epsilon_N^2/\kappa T)^{\frac{1}{2}}$, where the summation extends over all particles in a typical unit volume. The partial ordering thus introduced may be important when the charged particles act together coherently. Thus, for example, it brings about a reduction in the scattering cross-section, per electron, for electromagnetic radiation. (auth)

19500

PLASMA DYNAMICAL DETERMINATION OF SHOCK THICKNESS IN AN IONIZED GAS. E. N. Parker (Univ. of Chicago). Astrophys. J. 129, 217-23(1959) Jan.

It is shown that the principal interaction in a shock front in a tenuous ionized gas is a plasma interaction in which the ions transfer their translational energy to the plasma oscillations. The effect is, of course, of interest in auroral theories and in solar radio noise. It turns out to be the dominant effect in determining shock thicknesses nearly everywhere that the gas density is less than the solar photospheric value of 10^{16} atoms/cm^3. It is estimated that shock thicknesses in interstellar H II regions and in interplanetary space will be 1 km or less, even though the mean free paths may be 10^8 km or more and the ion Larmor radius ~100 km. (auth)

19501

ON THE RELATION BETWEEN HOLTSMARK'S MICROFIELD DISTRIBUTION FUNCTION AND THE CUTOFF VALUE OF THE COLLISION PARAMETER IN FULLY IONIZED GASES. O. Theimer and H. Hoffman (Univ. of Oklahoma, Norman). Astrophys. J. 129, 224-35(1959) Jan.

The Coulomb field with cutoff, commonly used for analyzing encounters of charged particles in a plasma, is replaced by a field which, on the basis of certain assumptions, is fully determined by the microfield distribution first introduced by Holtsmark (1919). Using a shielded Holtsmark distribution (Hoffman and Theimer 1957) a scattering potential is obtained. The diffusion coefficient $[(\Delta w_\perp)^2]$ (Spitzer 1956) is calculated from this potential, and the result is presented in terms of an equivalent cutoff parameter satisfying the approximate relation for most cases of practical interest. (auth)

19502

CALIFORNIUM-254, IRON-59, AND SUPERNOVAE OF TYPE I. Edward Anders (Univ. of Chicago). Astrophys. J. 129, 327-46(1959) Mar.

It is proposed that the exponential decline of type I supernova light-curves is due to the decay of 45-day Fe^{59} rather than 56-61-day Cf^{254}. If the iron-group elements are synthesized in a supernova core, as proposed by Hoyle (1946), then neutron capture by some of the Fe^{56} could produce a sufficient amount of Fe^{59} to account for the energy release of an average supernova. In contrast to the Cf^{254} hypothesis of Burbidge, Burbidge, Fowler, and Hoyle (1957), the Fe^{59} model can produce the light ($36 \leq A \leq 110$) as well as the heavy ($A > 110$) r process nuclides, both of them in solar-system proportions. In addition, the Fe^{59} model seems to offer the following advantages over Cf^{254}: only one sixth the number of neutrons is required; a less massive envelope (by a factor of 3) is needed: for a given level of past supernova activity, the predicted galactic abundances of r process nuclides are more nearly in accord with the observed abundances (by factors of 41-820); in order to yield the solar-system proportions of r and e process elements, the r process material produced in an average supernova outburst must be diluted by 1600 to 32,000 solar masses of Fe^{56} if Cf^{254} were responsible for the light-curve and only about 40 solar masses if Fe^{59} were responsible. Moreover, synthesis of the r process nuclides in the mass region $36 \leq A \leq 110$ via the Cf^{254} model seems to require the postulation of "dwarf supernovae" of −9 to −12 M, contrary to observation. It is shown that iron production by the mechanism of Hoyle should cause the supernova light-curve to be dominated by 270-day Co^{57}, 291-day Mn^{54}, and 2.6-year Fe^{55}. (auth)

19503

VELOCITY CHANGES OF CHARGED PARTICLES IN A PLASMA. F. D. Kahn (Princeton Univ., N. J.). Astrophys. J. 129, 468-74(1959) Mar.

A comparison is made of the different ways in which an ionized gas may change the velocities of fast-moving protons. It is found that a beam with a very well-defined velocity may lose its kinetic energy through the excitation of unstable oscillations, but it seems most unlikely that the stringent conditions necessary for this process will ever occur in any astrophysical application. Single protons lose energy by leaving a wake in the plasma (Pines and Bohm 1952). If sufficiently intense plasma oscillations are excited, the protons may also gain energy through acceleration in random electric fields. Fast electrons can be accelerated even more efficiently in this way. (auth)

19504

THE EFFECT OF FLUID MOTIONS ON THE STABILITY OF TWISTED MAGNETIC FIELDS. S. K. Trehan (Univ. of Chicago). Astrophys. J. 129, 475-82(1959) Mar.

The stability of twisted magnetic fields confined to an infinitely long cylinder of incompressible inviscid fluid of infinite electrical conductivity is investigated when fluid motions of varying amounts are present along the lines of force. It is found that the system is stable only when the energy in the velocity field is at least equal to that in the magnetic field. (auth)

19505

HYDROMAGNETIC EFFECTS UNDER CONDITIONS OF LOCALIZED THERMAL INSTABILITY. W. C. Levengood (Ball Brothers Research Corp., Muncie, Ind.). Astrophys. J. 129, 483-8(1959) Mar.

Thermal convection experiments were conducted in an attempt to explain previously observed hydromagnetic effects in silver patterns deposited on glass. Convective regions were produced in alcohol and alcohol-powder mixtures by locally heating with the poles of permanent magnets. Optical and weight-difference techniques were developed to compare observed differences in the convection process over the pole regions of the magnet. These phenomena suggested electric charge effects within the liquid, and the results were found to agree with the basic electrodynamics of charges moving in a magnetic field. These force effects on charged particles also provided an explanation for the observed differences in the silver-deposit patterns. The earth's magnetic field was found to have an effect on the localized convection process. The difference over the pole re-

gions was most pronounced when the magnet poles were aligned in the same position as the geomagnetic poles of the earth. (auth)

19506

THE RATE OF STAR FORMATION IN THE GALAXY. Edwin E. Salpeter (Cornell Univ., Ithaca, N. Y.). Astrophys. J. 129, 608-27(1959) May.

Consequences are derived from the following assumptions about the birth rate of stars in the entire Galaxy: this rate is proportional to a time-independent function ψ of magnitude M_v; ψ is given by the luminosity function for young galactic clusters; the birth rate per some volume is proportional to the gas mass in this volume. It is found that an appreciable fraction of the galactic mass was converted into stars in less than a billion years and that the mass of gas at present decreases only very slowly with time. Predicted luminosity functions are derived, and comparison with observation shows that the stellar birth rate should increase slightly more strongly with gas density than with gas mass. It is found that white dwarfs constitute about 0.17 of the total present number of stars. The total luminosity of the Galaxy is derived as a function of time. From a simple model for stellar helium production, the helium abundance in the gas is derived as a function of time. At present, this abundance for the gas is about four times the average abundance for gas plus all stars. Assuming medium-heavy nuclei to be produced by supernovae breakup of massive stars, their abundance in the gas is derived as a function of time. (auth)

19507

A METHOD FOR AUTOMATIC COMPUTATION OF STELLAR EVOLUTION. L. G. Henyey, L. Wilets, K. H. Böhm, R. LeLevier, and R. D. Levee (Univ. of California, Berkeley). Astrophys. J. 129, 628-36(1959) May.

A method is described for obtaining time sequences of stellar configurations automatically by means of high-speed digital computers. The time-dependent differential equations of stellar structure are replaced by second-order difference equations. These non-linear difference equations, together with the boundary conditions, are solved by an iterative method which is a generalization of the Newton-Raphson method for obtaining roots of functions. With the UNIVAC computer of the Livermore site of the Lawrence Radiation Laboratory, the method has been used in connection with various previously published studies of stellar evolution. (auth)

19508

A REVISED TABLE OF ABUNDANCES OF THE ELEMENTS. A. G. W. Cameron (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Astrophys. J. 129, 676-99 (1959) May.

The semiempirical abundance table of Suess and Urey has been very helpful to nuclear physicists in determining the relative importance of various mechanisms of nucleogenesis in contributing to the natural abundances of the elements. The table was based primarily on abundance determinations in chondritic meteorites, together with the hypothesis that the abundances of odd mass-number nuclides should lie on a smooth curve. It has recently become apparent that certain elements are over- or underabundant in the chondritic meteorites without apparent chemical reason. In order to throw additional light on such discrepancies and on certain less well-understood mechanisms of nucleogenesis, the abundance-curve has been re-examined, using some additional nucleogenesis-based criteria for the abundances of even mass-number nuclides, and a new table of abundances has been constructed. It was found necessary to change the Suess-Urey table substantially in the rare-earth region and in the lead region and to make isolated changes in the abundances of certain additional elements. Some conclusions have been drawn regarding the process of neutron capture on a fast time scale and the methods of production of bypassed heavy nuclei. (auth)

19509

THE PROPAGATION OF HYDROMAGNETIC WAVES OF FINITE AMPLITUDE IN A HORIZONTALLY STRATIFIED ATMOSPHERE. C. Plumpton (Univ. of London). Astrophys. J. 129, 752-7(1959) May.

The vertical propagation of a train of transverse harmonic hydromagnetic waves of finite amplitude in the presence of a uniform vertical magnetic field is discussed. It is shown that, although in this case the motion of the gas cannot be wholly horizontal, the vertical motion is negligible so long as the particle velocity is small compared with the local sonic velocity. Approximate solutions of the field equations are derived, and the results are discussed in relation to the propagation of waves in the solar atmosphere. (auth)

19510

HYDROMAGNETIC SHOCKS. J. Bazer and W. B. Ericson (New York Univ.). Astrophys. J. 129, 758-85 (1959) May.

All physically admissible solutions of the hydromagnetic shock relations for an ideal polytropic gas are exhibited and classified by purely analytical means. The state ahead of the shock (i.e., on the low-density side) is assumed to be known; no restriction is placed on the direction of the magnetic field in front. It is shown, apart from certain "limit" shocks (e.g., pure gas shocks), that the shock velocity and the quantities characterizing the state behind hydromagnetic shocks may be expressed as simple algebraic functions of the discontinuity in the magnetic field across the shock. A natural classification of all hydromagnetic shocks, based on this representation of the state behind the shock, is given. Several useful analytical properties of the various types of hydromagnetic shocks are derived. The results are illustrated graphically for the case of an ideal monatomic gas. The relation between earlier schemes of classification and the present scheme is discussed. (auth)

19511

ESTIMATES OF THE TOTAL ENERGY IN PARTICLES AND MAGNETIC FIELD IN THE NON-THERMAL RADIO SOURCES. G. R. Burbidge (Univ. of Chicago). Astrophys. J. 129, 849-52(1959) May.

A summary of the estimates (made in 1958) of the total energy in particles and magnetic field in the non-thermal galactic and extragalactic sources are given. These estimates are obtained from calculations by the theory of synchrotron radiation. (C.J.G.)

19512

THE MICROFIELD ON A NEUTRAL PARTICLE IN THE PLASMA. E. N. Parker (Univ. of Chicago). Astrophys. J. 129, 858-61(1959) May.

The shielding effect was approximated by the familiar cutoff procedure. In a comparison of Hoffmann and Theimer's calculations with the present work indicate that the uncertainties of their numerical and graphical

evaluation are of the same order of magnitude as the uncertainties in the present work. Therefore it is shown that the cutoff procedure used in numerical evaluation is valid and within the limits of accuracy. (C.J.G.)

19513

MAGNETOCONVECTION IN A VISCOUS FLUID OF INFINITE ELECTRICAL CONDUCTIVITY. W. V. R. Malkus (Woods Hole Oceanographic Institution, Mass.). Astrophys. J. 130, 259-75(1959) July.

A determination is made of the stable magnetic fields associated with steady-state convection in a fluid with no electrical resistance. The viscosity and thermal diffusivity which determine the amplitude of the fields are retained in the analysis. It is found that the most stable magnetic field is that one which alters the advection of momentum in a manner that minimizes the constraints on the convection. For the non-rotating fluid with small Prandtl number, the stable state is one of detailed local equipartition of magnetic and kinetic energy. For the rotating fluid the stable state can be one of vastly greater magnetic energy than kinetic energy. In speculating on the applicability of these results to astrophysical convection, it is suggested that the stable "magnetostrophic" fields are by far the largest part of the observed fields. (auth)

19514

HYDRODYNAMICS IN A RADIATION FIELD—A COVARIANT TREATMENT. J. Hazlehurst and W. L. W. Sargent (Univ. of Manchester, Eng.). Astrophys. J. 130, 276-85(1959) July.

An expression derived by Synge for the energy-momentum tensor of a photon gas has been used to derive the terms which must be added to the hydrodynamical equations of a perfect fluid when the fluid is flowing in a radiation field. The terms of order v/c and $(v/c)^2$ have been calculated explicitly and have been found to be in agreement with the earlier results of L. H. Thomas. The radiative viscosity has been found to be twice that predicted by Jeans, while the radiative conductivity is identical with that obtained by applying the results of the kinetic theory to a photon gas. (auth)

19515

THE ENERGY THEOREM IN THE MAGNETOHYDRODYNAMICS OF COMPRESSIBLE VISCOUS FLUIDS. Giovanni Carini. Atti acad. nazl. Lincei. Rend., Classe sci. fis., mat. e nat. 25, 470-3(1958) Dec. (In Italian)

The dissipative effects in the viscosity of a medium in magnetohydrodynamic problems have been studied by others using the Navier-Stokes or Maxwell equations. Generally the dissipative effect is due to the electric resistivity and the viscosity of the medium. The kinematic coefficient of viscosity is ν and the coefficient of resistance is η which has the same dimensions as ν. The dissipative effect in the electric resistance is much less notable than that of the viscosity only if $\eta \gg \nu$; this is verified in the example of mercury for which $\eta/\nu = 6 \times 10^6$. In this case it is legitimate to neglect the dissipative effect of viscosity. But in problems where η is not $\gg\nu$, for example in interstellar space where η/ν is of the order of 10^3, one must take ν into account. A steady-state energy equation is deduced for this system. (T.R.H.)

19516

THE NATURAL RADIOACTIVITY IN SOIL, WATER, AND AIR. H. Israël. Beitr. Physik Atmosphäre 30, 177-88(1958). (In German)

A survey is presented of the distribution of the natural radioactive matter in the ground, the water, and the air, and especially of its circulation from the exhalation from ground via its course through the atmosphere back to the ground. From the height distribution of this matter in the atmosphere the amount of the alpha-, beta-, and gamma-radiation in the different heights is computed. Experiences on the natural radioactivity in and above the oceans suggest that there is a surplus amount of radon in the sea water which makes it probable that there is a radon current rising from the bottom of the oceans. Its magnitude can be estimated as being about $0.5 \cdot 10^{-18}$ Curie/cm^2 sec. The radon exchange of the ocean with the air is caused by a pseudodiffusion coefficient of the order of 200 cm^2/day. (auth)

19517

SINGULARITIES NEAR THE CENTER OF EXPLOSION AND THE APPEARANCE OF TWO SHOCK WAVES. N. N. Kochina (Steklov Inst. of Mathematics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 1216-19(1959) June 21. (In Russian)

The problem of a point explosion in a compressed medium is studied considering the functions of motion close to those corresponding to automodel motions. (R.V.J.)

19518

DISTORTION OF THE GRAPHITE LATTICE IN THE PROCESS OF MECHANICAL DISPERSION. L. A. Feigin (Academy of Construction and Architecture, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 127, 313-15 (1959) June 11. (In Russian)

An attempt was made by mechanical dispersion to achieve a lattice disordering in graphite crystals in order to approximate the structure of amorphous carbon. A continuous crushing (hundreds of hours) in ball mills did not result in any radical changes in the picture of x-ray scattering. (R.V.J.)

19519

IMPROVED NONDESTRUCTIVE TESTING BY EDDY-CURRENTS. W. J. McGonnagle, C. J. Renken, and R. G. Myers (Argonne National Lab., Lemont, Ill.). Electronics 32, No. 35, 42-3(1959) Aug. 28.

Eddy currents of two different frequencies are induced in the specimen. One frequency is used to obtain the required information while the other is used to compensate for the variation in probe-to-specimen spacing and other undesirable effects. This dual-frequency eddy current system was developed for measuring the thickness of cladding on reactor fuel elements. The system is also applicable for measurements of plating thickness, wall thickness of metal tubing, and detection of subsurface cracks and voids. Diagrammatic explanations of both the high- and low-frequency channels are given. (C.J.G.)

19520

APPROXIMATION FOR CALCULATING SHOCK WAVES. G. M. Lyakhov and N. I. Polyakov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Mekhan. i Mashinostroenie No. 2, 13-18(1959) Mar.-Apr. (In Russian)

A method is suggested for calculating non-stationary shock wave interactions. The method is based on an approximation in which the curve expressing the law of compression of the medium $p = p(\rho)$ is replaced by a broken line with the component expressed as $p = A^2\rho^{-1} + B$, where A and B are constants within the limits of the given line. The method can be successfully applied to dense media where heat losses can be neglected at tens

or even hundreds of atmospheres. However, the suggested approximation can also be used in studies of shock waves in air when the front pressure does not exceed 2 to 3 kg/cm^2. (R.V.J.)

19521

THE PREPARATION OF A LARGE PLUTONIUM–BERYLLIUM NEUTRON SOURCE. K. L. Wauchope and J. Baird (Atomic Energy of Canada Ltd., Chalk River, Ont.). J. Nuclear Materials 1, 191-5(1959) July.

A plutonium–beryllium alloy neutron source, containing 100 g of plutonium and 68 g of beryllium, was prepared by the reduction of plutonium dioxide with beryllium followed by vacuum sintering at 1450°C to form a mechanically strong, non-friable compact. The compact was sealed in a double aluminum container. Neutron output from the source is $1.01 \pm 0.03 \times 10^7$ neutrons/second. In preparation of the source, tongs with 25 cm handles were used in all operations after mixing of the original ingredients, to prevent serious overexposure of personnel. The source is now in use for the calibration of neutron-counting instruments and for the irradiation of small experimental samples. (auth)

19522

THE DETERMINATION OF SURFACE AREAS FROM KRYPTON ADSORPTION ISOTHERMS. P. J. Malden and J. D. F. Marsh (Fulham Lab., London). J. Phys. Chem. 63, 1309-10(1959) Aug.

Small surface areas of solid catalysts were determined from measurements of the adsorption isotherms of krypton at −196°C. (J.E.D.)

19523

STUDIES OF A RADIOFREQUENCY ION SOURCE. János Erő and László Vályi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 414-27(1957) July-Aug. (In Hungarian)

In a consideration of the conditions under which an ion current of several amp may be obtained from a RF ion source, the suitable adjustment of the ion optical system formed in the cathode region proved to be of prime importance. A ratio of $I_{ion}/I_{iv} = 0.6$ could be obtained in this way. In order to avoid the gas inflow disturbing the focusing conditions, the gas inlet was displaced to the bottom of the discharge tube. In view of stable operation, the replacement of the permanent magnetic field by a rotating magnetic field was essential. The ion beam energy distribution was observed, and the magnitude of the energy spread was found to be dependent on the high frequency energy while being independent of the exhausting voltage and of the ion current. The proton content of the ion beam was found to be 70 to 80%. (auth)

19524

RADIATION OF A HIGH TEMPERATURE PLASMA. György Schmidt. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 57-63(1957) Jan.-Feb. (In Hungarian)

It is shown that the radiation of the high-temperature plasma is a space radiation instead of being a surface radiation, as previously assumed. It is proved that the energy production and the radiation output may reach equilibrium even at terrestrial dimensions; therefore, the radiation losses do not prevent the feasibility of a thermonuclear reactor. (auth)

19525

THE MULTIPLICATION FACTOR IN DEUTERON GAS. Gábor Kálmán. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 73-7(1957) Jan.-Feb. (In Hungarian)

The problem of the number of further fusion reactions produced by a single initial fusion reaction in cold deuteron gas is considered. According to the results considerably more than one reaction will be produced; thus a divergent chain reaction may occur. (auth)

19526

THE MEASUREMENT OF MAGNETIC FIELDS WITH PARAMAGNETIC RESONANCE ABSORPTION. Éva Koszó Kisdiné and László Turi. Magyar Tudományos Akad. Kozponti Fiz. Kutató Intézetének Közleményei 5, 225-30(1957) Mar.-Apr. (In Hungarian)

The measurement of a constant magnetic field with an accuracy of 10^{-4} to 10^{-5} may be reduced to frequency measurement by the use of paramagnetic resonance absorption. The resonant frequency is $\nu = \gamma/2\pi\ B_0$, where γ proton $= 2\pi \times 4.2575 \times 10^3$/sec gauss and γ electron $= 2\pi \times 2.804 \times 10^6$/sec gauss. Two simple methods are described for the measurement of magnetic fields, one of them using the proton resonance absorption in the radiofrequency region for fields of 200 to 20,000 gauss, the other using the paramagnetic electron resonance absorption in the microwave frequency region for fields of 100 to 3000 gauss. (auth)

19527

A LUNAR INTENSITY VARIATION OF COSMIC RADIATION AND ITS ORIGIN. E. Bagge and O. Binder (Universität, Kiel). Naturwissenschaften 46, 424(1959). (In German)

Measurements of cosmic meson intensity for the Geophysical Year showed a periodic variation of the length of a moon-day. The amplitude and phase of the period are: for observations in Kiel (10° 08′ 52″ E/54° 20′ 28″ N) cosmic radiation intensity decreases during transit of the moon. It reaches a minimum 3 to 5 hrs. after transit, as the moon nears the western horizon, and then increases to a maximum 17 to 20 hrs after transit. (T.R.H.)

19528

QUADRUPOLE INTERACTION IN SU_2-COUPLING AND CRANKING MODEL. Hartmut Pilkuhn (Physikalisches Staatsinstitut, Hamburg). Nuclear Phys. 12, 269-73 (1959) July (2).

For nuclei possessing stable deformations, the two-particle quadrupole interaction is expressed in terms of a deformed harmonic oscillator potential, and the moments of inertia in the corresponding coupling schemes (SU_2-coupling, and cranking model) are shown to be the same. (auth)

19529

PERMISSIBLE VOIDS IN PHOTON SHIELDS. D. G. Chappell (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 6, 140-6(1959) Aug.

Permissible void volume in photon shields is calculated in terms of shield thickness, photon energy, and permissible leakage factor. Several graphical aids for lead are presented. A simple method of void evaluation is included which may form the basis for an engineering acceptance test. (auth)

19530

TWO-GROUP ALBEDO THEORY AND APPLICATION TO TEMPERATURE COEFFICIENT CALCULATIONS. Alan Jacobs (Pennsylvania State Univ., University Park). Nuclear Sci. and Eng. 6, 147-51(1959) Aug.

A two-group albedo theory is developed which seems

to be valid for the calculation of temperature coefficients of nuclear reactors characterized by the PSR. Measurements of over-all coefficient for the PSR are in qualitative agreement with results calculated by the theory. Analysis under the present theory singles out the temperature variation of the ratio of the age to the thermal neutron diffusion length of the reflector as the primary contributor to a low temperature positive coefficient effect. The advantage of representing the criticality factor, k, by the two-group albedo theory is well illustrated by the endeavor of calculating the temperature coefficient. Under normal two-group multiregion treatment the criticality factor never explicitly appears and therefore it is impossible to obtain an explicit form of the variation of k with system parameters. The dissection of the nonleakage probability in the present theory is not unique, but it does lead to easy physical interpretation. (auth)

19531

THE TRANSFER FUNCTION OF A WATER-BOILER REACTOR. Richard L. Moore (Richard L. Moore Consultants, Los Angeles). Nuclear Sci. and Eng. 6, 157(1959) Aug.

An inconsistency in the usual assumptions of the space-independent kinetic equations for a water boiler reactor as stated by Skinner and Hetrick is given. (C.J.G.)

19532

MULTIGROUP DIFFUSION CALCULATION OF k_∞ FOR D_2O LATTICES. N. Tralli, J. Agresta, and W. Seibyl (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 6, 157-9 (1959) Aug.

19533

MEASUREMENTS OF THE TRANSPORT MEAN FREE PATH OF THERMAL NEUTRONS IN BERYLLIUM AS A FUNCTION OF TEMPERATURE. G. DeSaussure and E. G. Silver (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 6, 159-60(1959) Aug.

The variation with temperature of the transport mean free path of thermal neutrons in beryllium using the pulsed-neutron technique was investigated. The measured decay constants and corresponding values of the transport mean free path are presented. (C.J.G.)

19534

A NEW APPROXIMATE TREATMENT OF THE ENERGY-DEPENDENT BOLTZMANN EQUATION. C. Raymond Mullin (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 6, 160-2 (1959) Aug.

A new approximate treatment for a scattering kernel of nonconstant cross sections appears to give better results than the Selengut-Goertzel approximation. Applications of the new approximation are given. (C.J.G.)

19535

THE AGE OF PLUTONIUM–BERYLLIUM NEUTRONS IN LIGHT WATER. Frank A. Valente and Robert E. Sullivan (Rensselaer Polytechnic Inst., Troy, N. Y.). Nuclear Sci. and Eng. 6, 162(1959) Aug.

The ages of plutonium–beryllium neutrons in light water at indium (1.458 ev), rhodium (1.25 ev), and silver (5.18 ev) resonances are given. (C.J.G.)

19536

EFFECTIVE RESONANCE INTEGRAL FOR URANIUM CARBIDE. Russel Vernon (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 6, 163(1959) Aug.

Working from the theory of resonance integrals a formulation is obtained which, when applied to oxide and pure metal measurements, gives a useful estimate of the uranium carbide resonance integral. (C.J.G.)

19537

RADIATION-INDUCED CONDUCTIVITY IN THE SOLID STATE, AND SOME APPLICATIONS. John F. Fowler (King's Coll. Hospital, London). Phys. in Med. Biol. 3, 395-410(1959) Apr.

The mechanism of radiation induced conductivity is discussed with some of the factors which control sensitivity and speed of response in different substances. The relationships in a given substance between dose-rate response, temperature dependence, and decay time are described, from which the induced conductivity in the substance can be predicted. Applications of induced conductivity are discussed, including tissue-equivalent dosage measurement for interface problems; the use of semiconducting crystals for low dose-rate measurement; xeroradiography; and photoconductors in series with electroluminescent layers. Applications of the last-mentioned system include image intensifying panels, devices to visualize the distribution of an isotope in the human body, and others. (auth)

19538

TEMPERATURE MEASUREMENTS IN GAS BEHIND THE SHOCK WAVE. S. A. Losev and N. A. Generalov (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 3, 108-10(1959) May-June. (In Russian)

A method for measuring gas temperature using radiation and absorption properties of the sodium D-lines was adapted for measuring temperatures in gases behind shock waves (under laboratory conditions). The intense glow produced in the pulse tube IPS-500 is used for observations of absorption. Temperatures up to 5000°C were measured with a precision of ± 100 to 200°K. (tr-auth)

19539

USE OF DIAMOND DUST SUSPENSION IN DETECTION OF NUCLEAR SPALLATIONS IN CARBON. A. P. Zhdanov and P. I. Fedotov (Radium Inst., Academy of Sciences, U.S.S.R.). Pribory i Tekh. Ekspt. No. 3, 133(1959) May-June. (In Russian)

Diamond dust, 5 to 10 μ, was used as suspension material in observations of proton interactions with carbon nuclei. Several hundred spallations observed through photoplate glass with a long focusing objective 31×0.6 were found to be the spallations on diamond particles. (R.V.J.)

19540

ATTENUATION OF SCATTERED CESIUM-137 GAMMA RAYS. F. S. Frantz, Jr. and H. O. Wyckoff (National Bureau of Standards, Washington, D. C.). Radiology 73, 263-6(1959) Aug.

The intensity of the scattered gamma radiation decreases approximately linearly as the scattering angle increases to 90° but thereafter decreases very little. The attenuation of scattered cesium-137 gamma rays of an energy computed from the Comptom relation agrees with that obtained for scattered cobalt-60 gamma rays of the same energy with an accuracy usually required for protection work. (auth)

19541

ABSOLUTE THERMAL NEUTRON FLUX MEASUREMENT WITH INDIUM FOILS AND A 4 π COUNTER. Vera Maxia and Mario A. Rollier (Università, Cagliari, Italy). Ricerca sci. 29, 1199-1208(1959) June. (In Italian)

Some absolute thermal neutron flux measurements in a subcritical assembly carried out with activated indium foils in a 4 π flow counter are reported. This method does not need calibration with the neutron flux from a standard source and may be used for measuring absolute thermal neutron flux in any reactor. (auth)

19542

MIGRATION OF ATOMS OBSERVED IN A STUDY OF RADIOACTIVE MATERIALS. Giovanna Mayr (Università, Milan). Ricerca sci. 29, 1248-51(1959) June. (In Italian)

Experiments to study the phenomenon of materials becoming radioactive when exposed to a radioactive source are described. The sources used were Ra DEF, Ca^{45}, S^{35}, P^{32}, Au^{198}, Sr^{89}, T, and C^{14}. Samples were placed in contact with the sources for several days, then counted or autoradiographed. Experiments were also done on activation of natural crystals by contact with a radioactive source. An hypothesis is advanced in which it is suggested the radiation emitted by the radioelement causes ionization, breaking molecular bonds (especially where they are weak), resulting in excitation, diffusion, and exchange of atoms of the same chemical species between the two materials placed in contact. (T.R.H.)

19543

X-RAY DIFFRACTION STUDY OF THE BORIDES: YbB_6, LuB_4, HoB_4, and GdB_4. A. A. Stepanova and N. N. Zhuravlev. Soviet Phys.–Cryst. 3, 90-1(1958) Jan.-Feb.

The average coefficient of thermal expansion of YbB_6 is 5.85×10^{-6} deg^{-1}. The dimensions of unit cells of lutetium, holmium, and gadolinium borides determined from powder photographs taken at room temperature are presented in tabular form. (C.J.G.)

19544

THEORY OF THE FERMI FLUID. THE PROPERTIES OF LIQUID He^3 AT LOW TEMPERATURES. A. A. Abrikosov and I. M. Khalatnikov. Soviet Phys.-Uspekhi 1, 68-90(1958) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13 as Abstract No. 4889.

19545

DIRECT OBSERVATION OF OPTICAL VIBRATIONS OF A CRYSTAL LATTICE OF A SOLID BY MEANS OF NEUTRON SCATTERING. P. Chentsov. Soviet Phys.-Uspekhi 1, 165-6(1958) Sept.-Oct.

Experiments on scattering of slow neutrons in the investigation of the vibration spectrum of solids are reviewed. The investigations confirm the absence of a sharp discontinuity in the ω (k) curve and the presence of a double maximum on the ω (k) curve for some lattices. The energy spectrum of slow neutrons scattered by zirconium hydride and the resulting data on the optical vibrations of the hydride are discussed. (J.S.R.)

19546

MULTICONFIGURATION APPROXIMATION FOR ATOMS OF C, N, AND O. J. Vizbraite and A. Jucys. Trudy Akad. Nauk Litovskoĭ S.S.R., Ser. B No. 1(17), 17-34(1959). (In Russian)

An analysis is made of the multiconfiguration approximation applied for correcting formulas for C, N, and O atoms. A method is presented for expressing the energy matrix elements by radial integrals in cases when multiconfiguration approximation, based on dielectron states, is used in the equivalent electron configuration. Corrections for two-equivalent electron configurations are suggested for configurations with an arbitrary number of equivalent electrons. The numerical values of the distances between energy terms for certain C, N, and O type atoms is determined by multiconfiguration approximation based on the dielectron state model. Formulas expressing magnitudes in the theory of vector summation of moments, which are used for developing formulas for certain matrix elements of energy, are included. (tr-auth)

19547

ABOUT THE LUMINESCENCE OF COLORANTS ADSORBED ON CERTAIN SEMICONDUCTORS. I. A. Akimov. Zhur. Nauch. i Priklad. Fot. i Kinematografii 4, No. 1, 64-6(1959).

The luminescence of some colorants adsorbed on certain semiconductors were investigated. Several organic colorants were tested for their ability to luminesce in the absorbed state on silver and thallium halides and the oxides of certain metals. On these semiconductors, the sensibilization of the photoeffect can be observed. Among various other colorants, fluorescein, eosin, erythrosin, rodamin B extra, chlorophyll, and magnesium phthalocyanin were used for investigation. The source of light for the chemical stimulation was a chromatic device of high light intensity with diffraction lattice. The investigated colorants did not luminesce in the adsorbed state on ZnO, PbO, and the silver and thallium halides. But the same colorants adsorbed on MgO, BaO, TiO_2, paper, cotton wool, gelatin, and polyvinyl lacquer displayed an intensive luminescence. (TCO)

19548

THE BOND BETWEEN ELECTRONEGATIVITY AND ATOMIC REFRACTION. I. L. Agafonov. Zhur. Neorg. Khim. 4, 1270-6(1959) June. (In Russian)

An equation was derived for combining the relative electronegative magnitudes according to L. Pauling (The Nature of Chemical Bonds. Goskhimizdat. Moscow, 1947) with atomic refractions. The previously postulated assumption on the congruence of atomic volume of metals in atomic refractions was confirmed, and approximate values were found for the atomic refractions of At, Fr, Pa, Pm, Po, and Ra. (R.V.J.)

19549

ELECTROMAGNETIC WAVES IN THE PLASMA IN MAGNETIC FIELD. Ya. B. Fainberg and M. F. Gorbatenko (Khar'kov Inst. of Physics and Tech., Academy of Sciences, U.S.S.R.). Zhur. Tekh. Fiz. 29, 549-62(1959) May. (In Russian)

Propagation of electromagnetic waves in a plasma column placed in a constant uniform magnetic field and removed from the metallic walls was studied. The shape of the field was determined, the dispersion equation was derived, and numerical calculation was accomplished. (tr-auth)

19550

REFLECTION AND REFRACTION OF SHOCK WAVES AT THE BOUNDARY OF TWO MEDIA. II. A. I. Gubanov (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 615-24(1959) May. (In Russian)

A general equation was derived for the pressures of reflected and refracted shock waves at the boundary of two arbitrary media. The equation is approximate for low-intensity waves in two slightly differing media and in two strongly differing media. The angle of the reflection wave and the refraction index are calculated. (R.V.J.)

19551
STRESS ANALYSIS OF THE JUNCTION BETWEEN A SUPPORT SKIRT AND PRESSURE VESSEL. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-28. R. F. Wojcieszak (General Electric Co., Schenectady, N. Y.). New York, Engineers Joint Council, 1959. 10p. $0.50.

Simple, approximate formulas are developed for the determination of stresses resulting from internal pressure at the junction between a support skirt and pressure vessel. (auth)

19552
COSMOLOGICAL AND GEOLOGICAL IMPLICATIONS OF ISOTOPE RATIO VARIATIONS. Proceedings of an Informal Conference, Massachusetts Institute of Technology, June 13-15, 1957. Nuclear Science Series Report No. 23. NRC Publ. 572. Washington, D. C., National Academy of Sciences-National Research Council, 1958. 191p. $1.75.

Papers from a conference on nuclear processes in geologic settings are presented. The subjects presented in the papers concern meteorites, significance of variations in isotopic composition of lead from terrestrial samples, heat balances of the earth, significance of variations of light isotope abundances in oceanographic studies, and isotopic abundances of lighter elements. (C.J.G.)

19553
PRINCIPLES OF RADIATION DOSIMETRY. G. N. Whyte. New York, John Wiley and Sons, 1959. 130p.

There is as yet no universal agreement on the names to be assigned to some of the physical quantities that occur in dosimetry. Many of the terms used in this text are defined. Topics discussed include: the radiation field; the interactions of radiation with matter; the determination of x-ray spectral distributions; measurements of x-ray intensity; measurements of exposure dose; measurement of absorbed dose for x rays; dosimetry of charged particles; neutron dosimetry; and the design of secondary radiation detection instruments. (C.H.)

19554
THE INTERNATIONAL BIBLIOGRAPHY OF ELECTRON MICROSCOPY. VOLUME I, 1950-1955. New York, New York Society of Electron Microscopists, 1959. 172p.

This volume contains 4,054 references to the world literature published in the years 1950 through 1955 on electron microscopy. The bibliography is intended for practicing electron microscopists. (C.J.G.)

19555
EXPERIMENTAL TECHNIQUES IN LOW-TEMPERATURE PHYSICS. Guy Kendall White. Oxford, Clarendon Press, 1959. 335p.

Physicists in many laboratories around the world wish to carry out physical investigations in the low-temperature range and are faced with problems of designing cryostats, filling them with liquid helium, and maintaining and measuring various temperatures. The technical information and published experience which may help to solve them are spread over a wide range of years and journals. This book attempts to fill the need for giving details of this information, including physical data for the technical materials used in cryostat design, methods of measuring and controlling temperatures, and associated problems. (W.D.M.)

19556
ROENTGENS, RADS, AND RIDDLES. A SYMPOSIUM ON SUPERVOLTAGE RADIATION THERAPY HELD AT THE MEDICAL DIVISION, OAK RIDGE INSTITUTE OF NUCLEAR STUDIES, JULY 15, 16, 17, AND 18, 1956. Milton Friedman, Marshall Brucer, and Elizabeth Anderson, eds. Washington, D. C., U. S. Atomic Energy Commission, 1959. 509p. $3.50(GPO).

Radiation dosimetry is discussed in terms of radiation therapy. The roentgen is defined as a unit of exposure, not a unit of dose. The definition of the rad is discussed. It is pointed out that the amount of energy that is administered to a piece of tissue to make it change its metabolism is a unit but is not necessarily the only unit since the tissue may affect the rad just as the rad affects the tissue. Therefore, there is left a third unit not yet described and referred to as the riddle. Topics discussed include dosage considerations for supervoltage radiotherapy, dosimetry of moving fields, the design of apparatus and sources, installation problems, source production, principles of clinical supervoltage irradiation, case problems, and brachytherapy devices. (C.H.)

Elementary Particles

19557 AFOSR-TN-59-677
California. Univ., Berkeley. Lawrence Radiation Lab.
NOTE ON THE K-MESON NUCLEON INTERACTION. Robert Karplus, Leroy Kerth, and Thaddeus Kycia. [1959.] 11p. Contract AF49(638)-327. $3.30(ph), $2.40(mf) OTS.

It is to be expected that the experimental study of K-meson production, scattering, and absorption processes will shed light on the fundamental interactions of the strange particles. The recently measured angular distribution of the K^+-proton scattering cross section at various intermediate energies and the K^--proton scattering parameters permit a more accurate study of the K-nucleon-hyperon coupling terms than has previously been possible. Some inherent difficulties in a study of this type are discussed. (W.D.M.)

19558 CNF-2
Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.
SEARCHING FOR ρ^0 MESONS. A. Alberigi, C. Bernardini, and G. Stoppini. July 1959. 37p.

The need for a neutral ρ meson is based on several arguments which are reviewed. A study of kinematics and of those processes that can simulate a ρ^0 meson is presented. A sketch is given of a possible experimental arrangement suitable for detection of Nambu's variety of ρ^0 meson with some considerations on counting rate. (C.J.G.)

19559 NP-7793
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.
CENTRAL AND PERIPHERAL COLLISIONS OF FAST

NUCLEONS. V. S. Barashenkov, V. M. Maltsev, and E. C. Mihul. 1959. 15p.

Out of all the inelastic collisions at energies of 9 Bev about 83% are collisions of the central regions of the nucleons. In order to evaluate such "central collisions," use is made of the methods of the statistical theory for the multiple production of particles. The data obtained are in good agreement with the experiment excepting the region of small angles and the events with small number of particles. (auth)

19560 NP-7794

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.

THE INFLUENCE OF STRONG INTERACTION ON DECAY PROCESSES. N. Hu, N. N. Huang, and P. Wang. 1959. 15p.

It is shown that the strong interaction introduces not only phase shifts representing final-state interaction but also new parameters into the transition matrix for hyperon decay processes. These parameters must be determined by solving problems of physical hyperons under strong interaction with the π-meson and K-meson fields. As a consequence the selection rule read off from the Hamiltonian is in general different from that given by the transition matrix. The general consideration is also applied to the case of universal Fermi interactions including hyperons. Consistency with the selection rule $\Delta T = \pm 1/2$ cannot be achieved unless the interaction also includes the charge-retention pairs such as (N^+,N^+), (N^0,N^0) and (N^0,Λ^0). The theoretical difficulties of including these pairs are also discussed. (auth)

19561 NP-7815

Washington Univ., St. Louis.

THE POLARIZATION OF COSMIC RAY MUONS AT SEA LEVEL (thesis). Technical Report No. 4. Clarence Scott Johnson. July 1959. 77p. Contract NONR-816.

It is apparent that the partial polarization of cosmic ray muons depends upon the shape of the parent pion energy spectrum, and that by measuring the polarization at sea level one has a method of obtaining this spectrum. The polarization was measured by stopping the muons in copper, in which their polarization is largely preserved, and observing the asymmetry of the muon decay electrons; which is interpreted according to the two component theory of the neutrino. The magnitude of the partial polarization was found to be $< 21 \pm 3\%$. Assuming a power law for the parent pion differential energy spectrum, the slope of this curve was found to be $< 1.3 \pm 0.3$. (W.D.M.)

19562 ORO-206

Virginia. Univ., Charlottesville.

RESEARCH STUDIES WITH A 1-MEV VAN DE GRAAFF MACHINE. Annual Report. Frank L. Hereford. June 1959. 22p. DA Project No. 5B99-01-0001. Contracts AT(40-1)-1754 and DA-36-034-ORD-2046. (OOR-1510.6). $6.30(ph), $3.00(mf) OTS.

The elastic scattering of 2- to 4-Mev polarized neutrons by carbon, deuterons, heavy elements, and light elements, and the inelastic scattering of 15-Mev neutrons are discussed. In an effort to improve the detection techniques for neutrons in scattering experiments, a directional neutron counter was built, and this counter is described. The results of a study of the precession of the neutron magnetic moment in the interior of a ferromagnet are also presented. (auth)

19563 UCRL-8754

California. Univ. Berkeley. Lawrence Radiation Lab.

PRODUCTION AND DECAY OF THE K^0 MESON (thesis). Sherwood Parker. May 18, 1959. 90p. Contract W-7405-eng-48. $2.25(OTS).

The production and decay of strange particles were studied by observing the space around a Bevatron target with a well-collimated gamma detector. Strange particles that have π^0 modes of decay can send gammas up to the detector from the subsequent decay of the π^0. The observed-gamma counting rate as a function of the detector and collimation position was then compared with that predicted for various assumptions about the production matrix element. The data require contributions to the counting rate from two known decay modes, $K^0 \rightarrow \pi^0 + \pi^0$ and $K^\pm \rightarrow \pi^\pm + \pi^0$, $\pi^0 \rightarrow \gamma + \gamma$. It is also consistent with limited contributions from $\Lambda^0 \rightarrow \pi^0 + n$, $\Sigma^+ \rightarrow \pi^0 + p$, $\Sigma^0 \rightarrow \Lambda^0 + \gamma$, $\Lambda^0 \rightarrow \pi^0 + n$, but cannot give any information about these decays. The observed angular distribution requires that a significant part of the K^0 production be sharply peaked at high energies and at angles close to the line of collision of the incoming nuclei. The peaked part of the angular distribution can be fitted by $\cos^k\theta_{Kc}$, where θ_{Kc} is the polar angle of the K particle in the center of momentum system, and $k \geq 8$, with the best fits for $k = 12$ to 16. (auth)

19564 CEA-tr-A-390

FREINAGE DES NEUTRONS RAPIDES DANS DES MILIEUX À HAUT NOMBRE D'ORDRE. (Bremsstrahlung of Fast Neutrons in Media with High Order Number.) Hans-Wilhelm Schmidt. Translated into French from Z. Physik 148, 128-34(1957). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 13429.

19565

SELECTION RULES IN THE ONE K-MESON THEORY. G. Marx (R. Eotvos Univ., Central Research Inst. of Physics, Budapest). Acta Phys. Acad. Sci. Hung. 7, 469-72(1957). (Translated from Referat. Zhur. Fiz. No. 11, 1958, Abstract No. 24643.)

Selection rules, which occur in the annihilation of a found nucleon-antinucleon system were examined. The decay of neutral K mesons with allowance for the conservation of combined parity was also investigated. (auth)

19566

PROBLEMS OF MULTIPLE PARTICLE EMISSION. G. Domokos (Central Research Inst. of Physics, Budapest). Acta Phys. Acad. Sci. Hung. 10, 7-17 (1959).

Qualitative features of a multiple emission process of nuclear particles are discussed. A possible qualitative model is established for the description of events of this kind. Some measurements are proposed in order to clarify further the characteristics of the process. (auth)

19567

ON ISOBARS OF THE NUCLEON CAUSED BY THE KAON FIELD IN A FIXED-SOURCE THEORY. W. Królikowski (Warsaw Univ.). Bull. acad. polon. sci., Ser. sci., math., astron. et phys. 7, 245-50(1959).

Quantitative results show the possibility of high-energy excitations of the nucleon caused by the baryon-kaon interaction. Considerations of the present paper lead to the possibility of excitations connected with both

the S-wave and P-wave kaons in the cloud of the nucleon. (C.J.G.)

19568

A FIXED-SOURCE APPROACH TO SCATTERING OF KAONS. W. Królikowski (Warsaw Univ.). Bull. acad. polon. sci., Ser. sci., math., astron. et phys. 7, 237-44 (1959).

A fixed-source approach of the Chew-Low type is applied to the scattering of K mesons on nucleons. This baryon-particle is represented by a fixed source with some internal degrees of freedom corresponding to spin, isospin, and strangeness of the baryon. (C.J.G.)

19569

EVIDENCE OF THE SCATTERING OF 2.62-Mev PHOTONS BY THE ELECTRIC FIELD OF NUCLEI (DELBRÜCK EFFECT). Lazare Goldzahl and Philippe Eberhard (College de France, Paris) and Henri Cornille and Marc Chapdelaine (École Normale Supérieure, Paris). Compt. rend. 249, 401-3(1959) July 20. (In French)

The Delbrück effect, photon scattering by the electric field of nuclei, can be shown by a significant difference between the measured cross section of coherent scattering and the calculated sum of the Rayleigh scattering of electrons and the Thomson scattering of the nucleus. The cross section for coherent scattering of 2.62-Mev γ rays has been determined and verified for lead, and it was shown that nuclear resonance played no role in this scattering. The calculation of the Rayleigh and Thomson effects was made for lead. A comparison of the measured coherent scattering with the results of the calculation shows the existence of the Delbrück effect. (J.S.R.)

19570

MEASUREMENT OF THE MULTIPLE SCATTERING OF PROTON TRACKS HAVING ENERGIES OF 6 AND 2 Bev IN NUCLEAR EMULSIONS. Brigitte Dépaux and M. Tsai-Chü. Compt. rend. 249, 404-6(1959) July 20. (In French)

The multiple scattering of proton tracks was measured in nuclear emulsions exposed to 2- and 6-Bev proton beams. In the deflection method, the background noise of the emulsion, caused by the dislocation of the emulsion crystals, increases linearly with the cell length. The corresponding angle can be considered as a constant, and it can be eliminated by the formulas of the tangent method. (tr-auth)

19571

STUDY OF THE PENETRATING SHOWERS PRODUCED BY COSMIC RADIATION IN LITHIUM AND OBSERVED WITH A WILSON CLOUD CHAMBER. M. Gribi, F. Heinrich, H. Loeliger, J. M. Pictet, A. Rytz, H. Wüffler, and M. Walter (Université, Zurich). Helv. Phys. Acta 32, 213-48(1959). (In French)

The interactions in lithium of high-energy charged cosmic-ray particles were studied by means of a Wilson cloud chamber, which was set up 11,350 ft above sea level. The lithium target was located just above the chamber, which contained three gold plates. The results obtained from the analysis of 197 lithium showers are described. The integral distribution of the multiplicity n of the charged secondaries was extracted, corrected, and plotted. The development through the chamber plates of the electron cascades created by the disintegration photons of neutral π mesons was studied for 96 showers. The total energy E_{π_0} of the neutral π meson component was measured for each shower and the integral distribution of these values plotted. The average energy $\bar{E}_{\pi_0}$ was determined for each multiplicity n and conversely, the average multiplicities n corresponding to different energy groups $E_{\pi 0}$. The absorption and interactions of the shower secondaries in the chamber plates were also studied. Finally, the frequency of emission of V° particles in showers created in a lithium target was compared with the corresponding value measured with an aluminum target. The multiplicity and energy distributions were analyzed from two points of view: the plural theory and the multiple theory of meson production. The model proposed by the first theory was developed and found to be in good agreement with the results. A comparison with the second theory was found difficult because of the large fluctuations that it predicts. The characteristics of the showers observed in this experiment, with a target located outside the chamber, were found to be very similar to those observed in other experiments where the target was located inside the chamber. (auth)

19572

CORRELATION OF ENERGY LOSSES OF SUCCESSIVE CHARGED HEAVY PARTICLES IN ELECTRON GAS. Gábor Temes. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 78-83(1957) Jan.-Feb. (In Hungarian)

The decrease of the energy loss of a heavy particle injected into an electron gas was examined, when other heavy particles were injected previously. The results show a decrease in the energy loss. This decrease is, however, too small to be of any practical use. (auth)

19573

DETERMINATION OF PRIMARY ENERGIES OF JETS BY THE MAXIMAL LIKELIHOOD METHOD. György Bozóki and Éva Gombosi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 167-77(1957) Mar.-Apr. (In Hungarian)

The maximum probability method for determining the primary energies of jets developed by Dilworth et al. is discussed. The application of the method is extended to the angular distribution of secondary particles as given by Heisenberg's and Landau's meson production theories since the relations derived by Dilworth et al. apply only to the angular distributions interpreting Fermi's meson production theory. Statistical errors are calculated for each case. (auth)

19574

REMARKS ON THE DETERMINATION OF PRIMARY ENERGY OF JETS. Gábor Domokos. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 178-82(1957) Mar.-Apr. (In Hungarian)

The method of Castagnoli et al. for the determination of primary energies of jets is applied to Landau's angular and energy distribution. Curves are presented for the determination of the primary energy of a jet and the relative error of the energy measurement. (auth)

19575

EMISSION OF HEAVY UNSTABLE PARTICLES FROM EXTREMELY ENERGETIC NUCLEON-NUCLEON COLLISIONS. Gábor Domokos. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 183-7(1957) Mar.-Apr. (In Hungarian)

Production rates are calculated for heavy unstable particles emitted in extremely energetic nucleon-nucleon collisions. Calculations are carried out within

the framework of the Fermi-Landau thermodynamic theory, taking into account the conservation of T_3, N, and the isobaric parity. The calculated production rates do not contradict present experimental results. A qualitative argument is proposed to resolve the possible contradiction with the energy distribution, deduced from experiments on extensive air showers. (auth)

19576

STUDY OF THE SLOWING DOWN OF FAST NEUTRONS. Lajos Nagy and Ottó Orient. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 253-62(1957) Mar.-Apr. (In Hungarian)

The density distribution of thermal neutrons was determined experimentally. The relaxation length and the mean square slowing down length were calculated. For the measurements, a Pa + Be alpha-neutron source of 100 mc was used with water as moderator. According to the experiments the relaxation length was found to be $\gamma = 10.17 \pm 0.25$ cm and the mean square slowing down length $r^2 = 390 \pm 7.6$ cm^2. (auth)

19577

SELECTION RULES IN THE ONE K-MESON THEORY. György Marx. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 301-4(1957) May-June. (In Hungarian)

The selection rules of the annihilation of nucleon-antinucleon pairs and the K decay in pions are investigated. The process of the nucleon-antinucleon annihilation is dependent on the parity singlet or parity doublet character of the K mesons. (auth)

19578

THE CONSERVATION OF THE NUMBER OF FERMIONS AND THE PRINCIPLE OF THE NEUTRINO THEORY. György Marx. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Kozleményei 5, 305-14(1957) May-June. (In Hungarian)

In the theory of the neutrino, two simplifying assumptions can be introduced: the law of conservation of the number of fermions and the principle of minimum number of elementary particle states. In the realm of the "classical" β decay theories the Fermi neutrino satisfies the first and the Majorana neutrino the second assumption. After the discovery of the non-conservation of parity the satisfaction of both assumptions by the same theory became possible; it is satisfied by the Landau neutrino. The consequences of the two principles for μ-meson decay and for other particles are investigated. (auth)

19579

SPECULATIONS CONCERNING THE STRUCTURE OF STRANGE PARTICLES. Géza Györgyi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 315-25(1957) May-June. (In Hungarian)

A comprehensive review is given on the models of strange particles proposed by Fermi, Feynmann, Goldhaber, Márkov, Sakata, and the author. The consequences following from these models are analyzed. The physical meaning of strangeness is discussed. (auth)

19580

SOME EXPERIMENTAL POSSIBILITY FOR THE INVESTIGATION OF PARITY NONCONSERVATION IN β DECAY. József Mraz. Magyar Tudományos Akad. Központi Fiz. Kutato Intézetének Kozleményei 5, 326-30(1957) May-June. (In Hungarian)

Because of nonconservation of parity in β decay the negatons and the γ rays following the β decay are polarized in some degree. Some experiments planned for the investigation of polarization effects in β decay are described. (auth)

19581

ON THE DETERMINATION OF THE ENERGY OF A PARTICLE SCATTERED IN AN EMULSION TAKING INTO ACCOUNT THE NOISE. Géza Györgyi and Lajos Jánossy. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 331-7(1957) May-June.

The probability density $P(b,c; \underline{D}^N)$ that the second differences of the measured coördinates of a track in an emulsion take on the values $D_0, D_1, \ldots, D_N$ is determined, if the scattering constant b and the constant c of spurious scattering possess definite values. Using the expression obtained for $P(b,c; \underline{D}^N)$, the constants b and c can be determined from the measured values D^N with the aid of the maximum probability theorem. (auth)

19582

DETERMINATION OF THE RATIO OF PHOTONS TO ELECTRONS IN EXTENSIVE COSMIC RAY SHOWERS BY MEANS OF A CLOUD CHAMBER. István Dohán, Tibor Gémesy, Tamás Sándor, and Antal Somogyi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 461-8(1957) Sept.-Oct. (In Hungarian)

Seven lead plates having a total thickness of 33 mm were placed into a cloud chamber which had an effective cross section of 300 cm^2. The chamber was controlled by an extensive air shower unit. In order to evaluate the photographs the primary electrons entering the chamber as well as the electron pairs produced in the lead plates by primary photons were counted. Correcting for the possible number of photons penetrating without interaction, the ratio photons to electrons was found to be $\alpha = 1.16$ for 84 Mev primary photon energy. The results are compared with GM counter measurement data obtained by other authors. (auth)

19583

INTENSITY OF COSMIC RADIATION UNDER 17 m.w.e. BELOW GROUND. Tamás Sándor, Antal Somogyi, and Ferenc Telbisz. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 469-82(1957) Sept.-Oct.

From January 7 until May 4 1957, the variation of cosmic radiation intensity 17 mwe below ground was measured by means of two identical counter telescopes having wide solid angles, the telescopes operating independently of each other. From the number of coincidences obtained, in all about 25 million, the barometric coefficient of the penetrating component was determined to be $-0.99 \pm 0.03\%$ per Hg mm. A method was developed which allowed, from measurements carried out simultaneously with the two instruments, the determination of both the degree of instability of either instrument and the systematic variation of the measured flux. (auth)

19584

MEASUREMENT OF THERMAL NEUTRON FLUX BY ACTIVATION METHOD. András Adám and István Lovas. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 521-34(1957) Sept.-Oct. (In Hungarian)

The relation between the neutron flux and the activity

resulting from neutron capture is considered. The principle of absolute activity measurement by coincidence method is outlined. The construction of a measuring apparatus working with GM tubes and scintillation counters is described. Finally the problem of evaluating the results of the measurements, including determination of the error, is treated. (auth)

19585

STUDIES OF KAZAKH SCIENTISTS ON COSMIC RADIATION. Zh. S. Takibaev. Vestnik Akad. Nauk S.S.S.R. 29, No. 5, 101-4(1959) May. (In Russian)

A review is given of research performed by Kazakh scientists in the field of cosmic radiation. The improved method for measuring multiple Coulomb scattering in photoemulsion and the statistical material on the emission of high-energy multicharged fission fragments are briefly discussed as well as future studies on the mechanism of nuclear fission and elementary particle interactions at <1000 Bev. (R.V.J.)

19586

THE COMPTON CURRENT. Bernhard Gross (Instituto Nacional de Tecnologia, Rio de Janeiro). Z. Physik 155, 479-87(1959).

The secondary electrons produced by penetrating x rays and gamma rays move preferentially in the forward direction. In an insulator, absorption of the photon beam is therefore accompanied by an electron current. The current can be measured by a suitable receiver that collects the electrons and absorbs the photons. In this paper an approximate expression for the Compton current is established. Results of preliminary measurements are given and found to be in satisfactory agreement with the theory. (auth)

19587

POLARIZATION OF NUCLEONS SCATTERED BY NUCLEI. Gregory Breit and John Stanton McIntosh (Yale Univ., New Haven). p.466-95 of "Handbuch der Physik. Band XLI/1. Kernreaktionen II: Theorie." (Encyclopedia of Physics. Volume XLI/1. Nuclear Reactions II: Theory). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 586p.

The polarization of nucleons scattered by nuclei yields useful information regarding the compound state of the nucleon-nucleus system. Basic relations are discussed. Polarization of particles with spin ½ scattered by spinless targets and polarization produced in scattering from complex potential wells are considered. (W.D.M.)

Heat Transfer and Fluid Flow

19588 AECU-4167

Minnesota. Univ., Minneapolis.

PROGRESS REPORT FOR RESEARCH ON HEAT TRANSFER TO FLUIDS FLOWING THROUGH NON-CIRCULAR CHANNELS. J. P. Hartnett and C. Y. Koh. June 1959. 12p. Contract [AT(11-1)-659]. $3.30(ph), $2.40(mf) OTS.

Calculations of velocity distributions and friction coefficients were completed for five rectangular channels with aspect ratios of 2:1, 5:1, 10:1, 20:1, and ∞:1. The Reynolds numbers are from 3×10^3 to 2×10^6. Results are shown. Friction coefficients for flow in a circular pipe are shown for comparison. It is seen that in the low Reynolds number region, the friction coefficient for circular pipe is lower than that for the rectangular channel with an aspect ratio of 5:1. For the Reynolds number between 1.5×10^4 to 10^6, it is about the same as that of the 10:1 rectangular duct. For higher Reynolds number, the friction factor for flow in circular pipe approaches that for flow between two parallel plates. (auth)

19589 JPL-Memo-30-8

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

ON THE MECHANISM OF SUBCOOLED NUCLEATE BOILING. S. G. Bankoff. Feb. 5, 1959. 52p. Contract NASW-6.

The mechanism of heat transfer in forced convection subcooled nucleate boiling is considered. A three-step model is proposed. First, the heat flows from the wall into the adjacent liquid by two parallel paths: (a) the portion of the wall area which is periodically covered by bubbles is primarily cooled by quenching, due to colder liquid rushing in as the bubbles collapse; (b) over the remainder of the wall area, convective heat transfer is induced primarily by the stirring effect of the bubbles. Secondly, heat flows through the two-phase wall layer, partly by turbulent convection in the liquid between the bubbles, and partly by latent heat transport within the bubbles themselves. Finally, the heat flows by turbulent convection from the edge of the two-phase wall layer into the turbulent core. Simplified expressions are deduced for the first and third steps, which give reasonable agreement with Gunther's data. The relative importance of latent heat transport is as yet uncertain, but it is shown to be very likely significant in comparison with the heat flow through the liquid between the bubbles. Expressions are deduced for the quenching heat flux and the mean velocity induced by the bubbles. The liquid temperature at the edge of the two-phase wall layer is computed for Gunther's data and is found to rise sharply towards the saturation temperature as burnout is approached. This signifies that the maximum heat flux coincides with the appearance of a fairly thick layer of warm water next to the wall, possibly due to the inability of the turbulent core liquid to remove the heat as fast as it is transmitted through the two-phase wall layer. The heat flow expressions which have been derived are quite approximate; considerably more data on the local parameters in subcooled nucleate boiling are required before they can be put on a firm footing. On the other hand, the three-step model is not considered to be speculative; it is, in fact, a simple statement of the physical situation in highly subcooled nucleate boiling. (auth)

19590 NP-7779

Massachusetts Inst. of Tech., Cambridge. Div. of Sponsored Research.

SLUG FLOW. Technical Report No. 15. Peter Griffith and Graham Wallis. May 1, 1959. 41p. Project No. 7-7673, Contract Nonr-1841(39).

Slug flow characterized by large bubbles which almost fill the tube and separated by slugs of liquid was studied. Results and conclusions are presented for such a flow in round vertical pipes. Calculation methods are summarized, and procedures and apparatus are described. (J.R.D.)

19591 OOR-2000:1

Northwestern Univ., Evanston, Ill.

EFFECT OF DENSITY VARIATION ON HEAT TRANSFER IN TURBULENT FLOW. Interim Technical Report No. 1 [for] September 1, 1958–June 30, 1959.

Yih-Yun Hsu and J. M. Smith. 32p. DA Project No. 5B99-01-004. Contract DA-11-022-ORD-2674.

The heat transfer coefficient between fluid and tube wall in turbulent flow depends upon the physical and thermal properties of the fluid. When density changes across the diameter of the tube are large (for example, when the fluid is near the critical point), the variable density can affect the transfer of momentum and heat. Equations are developed for predicting the magnitude of this effect on the heat transfer coefficient. Deissler's expressions for the eddy diffusivity are employed in solving the equations for heat and momentum transfer. The results are applied to carbon dioxide in turbulent flow at 1200 psia. Comparison with the experimental data of Bringer and Smith for carbon dioxide indicate good agreement. On the other hand, the heat transfer coefficients predicted by neglecting the effect of density variations on momentum and heat transfer do not agree with the data. (auth)

19592 UMRI-2431-4-P

Michigan. Univ., Ann Arbor. Research Inst.
TESTS ON MODELS OF NUCLEAR REACTOR ELEMENTS. IV. MODEL STUDY OF FUEL ELEMENT SUPPORTS. A. C. Spengos. July 1959. 31p. For Atomic Power Development Associates, Inc.

Head losses were determined for flow through a bundle of fuel element rods supported by four different forms of supports at variable spacings. The drag coefficient for each type of support was computed from the measurements of the pressure drop, and the influence of the boundary proximity was determined. (auth)

19593 WAPD-V(FBE)-159

Vitro Engineering Co., New York.
SECOND COMPILATION OF CURRENT WORK ON TRANSIENT BOILING. REPORT NO. 2. S. K. Hellman, S. Kaminsky, and R. W. Kupp. [1959]. 11p. For Westinghouse [Electric Corp. Bettis Atomic Div.]. Subcontract 73(14-1025). $3.30(ph), $2.40(mf) OTS.

A brief account of the current and projected transient boiling work going on at Atomics International, Ramo-Wooldridge, National Aeronautical Space Administration, General Electric, University of Illinois, and Massachusetts Institute of Technology is presented. Abstracts of some Japanese papers are presented. (W.L.H.)

19594 AEC-tr-3751

COMPARISON METHOD FOR THE DETERMINATION OF THE HEAT CONDUCTIVITY OF CERAMIC MATERIALS. (Vergleichsverfahren zur Ermittlung der Wärmeleitfähigkeit Keramischer Werkstoffe.) F. Klasse, A. Heinz, and J. Hein. Translated for Oak Ridge National Lab. from Ber. deut. keram. Ges. 34, 183-9(1957). 28p. (Includes original, 6p.). $4.80(ph), $2.70(mf) JCL.

A comparison method for the determination of the thermal conductivity of ceramic materials, which can be performed quite easily, was developed. The thermal conductivity is obtained from a comparison of the temperature gradient occurring in two bodies in series (test and standard bodies) during constant heat flow whereby the lateral heat losses resulting in inaccuracies are eliminated by standardizing the instrument. The reproducibility of the test method is favorable. The relative accuracy of the method amounts to ±2% of the value. The equipment can be easily assembled and is not only suitable for routine determinations in the ceramic laboratory but can be utilized successfully in scientific research on account of the good reproducibility of the method. (auth)

19595 AERE-Lib/Trans-814

LIQUID BOILING WITH HEAT SUPPLY THROUGH THE WALL. S. V. Polozhii. Translated by P. J. Kelley (U.K.A.E.A., Atomic Energy Research Establishment) from Izvest. Tomsk. Politekh. Inst. im. S. M. Kirova 80, 24-40(1955). 22p.

The basic contradiction in the process of vapor formation with supply of heat through a wall is the limited possibility of increasing the intensity of the process. Increase of heat flux is possible so long as purely "nucleate" boiling continues. Quantitative changes in this process lead to a sharp reduction of the coefficient of heat-transfer which raises the temperature of the wall and reduces the admissible heat flux. The present trend of the steam-powered cycle, to use very high pressures, may meet with the obstacle related to low heat fluxes that are permissible with very high pressures, limitation being caused by change to film boiling at a low degree of superheating. (C.J.G.)

19596

DETERMINATION OF LOCAL HEAT TRANSFER COEFFICIENTS BY A TRANSIENT TECHNIQUE. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959. Public Auditorium, Cleveland, Ohio. Preprint V-40. R. A. Stanley and J. B. Conway (General Electric Co., Cincinnati). New York, Engineers Joint Council, 1959. 15p. $0.50.

A transient technique was employed to determine local heat transfer coefficients for a tube, for two parallel flat plates, and for two parallel corrugated plates. Coefficients were determined for bulk air temperatures of 70, 300, and 500°F in the Reynolds Number range of 20,000 to 70,000. (auth)

19597

HEAT TRANSFER ENGINEERING. Hilbert Schenck, Jr. Englewood Cliffs, N. J., Prentice-Hall, Inc., 1959. 318p.

The book rests on two fundamental concepts: the first law of thermodynamics, referred to as the "energy balance," and various "rate equations" which are named for their originators. Starting with these ideas, the total structure of heat transfer from the basic design of a plane wall to the complete specifications of a compactly finned heat exchanger is built. Various modes of thermal energy transfer are covered chapter by chapter as separate segments of the complete science, then systems involving two or more of these basic mechanisms are discussed, and finally, whole thermal systems comprising several components are described. The last chapter outlines some of the principles of heat transfer test work for conjunction with experimental exercises. Sufficient examples are given to allow the reader not strong in dimensional methods to grasp the techniques. The formal solution of partial differential equations has been replaced, wherever possible, with approximated analytic solutions involving elementary integrals. Theory and design of heat exchangers and other complete units are given substantial space in the book. (C.J.G.)

Nuclear Properties and Reactions

19598 AECU-4246

Los Alamos Scientific Lab., N. Mex.
BIBLIOGRAPHY OF NEUTRON YIELDS FROM THE

REACTIONS p + T, d + D, AND d + T (1954 TO SEPTEMBER 1957). Soliska Harris and Helen Stearns, comps. 8p. Contract [W-7405-eng-36]. (D-BIB-12). $1.80(ph), $1.80(mf) OTS.

Thirty four references are presented. The sources used include Nuclear Science Abstracts, 1954 to 1957, Amer. Phys. Soc. Bulletin, 1954 to 1957, and Report Library Catalog. (J.R.D.)

19599 AECU-4253

Purdue Univ., Lafayette, Ind.

SCATTERING OF 18-MEV ALPHA PARTICLES BY C^{12}, O^{16}, AND S^{32}. J. C. Corelli, E. Bleuler, and D. J. Tendam. 1958. 39p. $7.80(ph), $3.30(mf) OTS.

The scattering of 18-Mev alpha particles by gaseous C_3H_8, O_2, and H_2S targets was studied with a multiplate scattering chamber. The elastic angular distributions exhibit the diffraction-like pattern typical of light elements. Carbon and oxygen show a sharp rise above the Rutherford cross sections at the backward angles, with values σ/σ_R of 660 for carbon and 350 for oxygen near 173°. A good fit to the angular distribution for inelastic scattering leading to the first excited state of C^{12} (4.43 Mev, 2^+) is obtained using a $[j_2(qR)]^2$ dependence with $R = 5.5 \times 10^{-13}$ cm. No direct-interaction analysis is possible for the alpha-particle groups corresponding to the 7.65-Mev and 9.61-Mev levels in C^{12} and to the excited states of O^{16} up to the 8.87-Mev level. All these distributions show strong forward peaking. In the case of inelastic scattering by S^{32} ($Q = -2.24$ Mev), an interaction radius of 6.5×10^{-13} cm can be deduced from the angular distribution, though the agreement with $[j_2(qR)]^2$ is rather poor. A summary of elastic scattering results for elements in the range from Z = 6 to Z = 47 is presented. Expressions for the second-order geometry and the multiple-scattering corrections are given. (auth)

19600 AERE-R-2891

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ANOMALOUS RADIATIVE CAPTURE IN THE RESONANCE REGION. A. M. Lane and J. E. Lynn. May 1959. 51p.

Starting from nuclear dispersion theory, a formalism is presented for the analysis of capture reaction cross sections at energies in the resonance region. Account is taken not only of capture through local resonances but but also of "direct" or "potential" capture. The latter contributes to the cross section a smooth background with which resonances interfere. Estimates show that, in certain favorable cases, the direct capture can dominate. An important feature of direct capture (and also of the channel contribution to resonance capture) is that it tends to select final single particle states and so gives rise to anomalous groups in the photon spectrum. The experimental data on thermal capture are analyzed in terms of these ideas. (auth)

19601 AFOSR-TN-59-595

California Inst. of Tech., Pasadena. Antenna Lab.

ASYMMETRICALLY EXCITED ELECTROMAGNETIC RADIATION FROM CIRCULAR CYLINDERS OF FINITE LENGTH AND PROLATE SPHEROIDS. Technical Report No. 19. Hans H. Kuehl. June 1959. 117p. Contract AF18(600)-1113. (AD-217182).

The far zone radiation from two types of asymmetrically excited systems is considered. The first is a finite cylinder excited by an electric dipole in the radial direction near the cylinder. The second is a prolate spheroid excited by a narrow belt of electric field around the surface of the spheroid. In both cases the body considered is perfectly conducting and the excitation is not necessarily centered at the midplane of the body. In the case of the finite cylinder excited by a radial dipole, an approximate method is used in which the current on the finite cylinder is taken to be identical with the current which would exist on an infinite cylinder under the same excitation. This approximation is shown to be valid analytically and experimentally if the cylinder is not short. The analytic and experimental results are compared for two cylinder lengths. The turnstile antenna mounted on a finite cylinder is considered analytically, and the modification of the radiation by the cylinder is exhibited. In the case of the prolate spheroid excited by a narrow belt of electric field, experimental results are compared to analytic expressions. The differences between the experimental and analytic results are considered. The considerations in obtaining accurate experimental results in both asymmetrically excited systems are discussed. (auth)

19602 AFOSR-TN-59-788

Miami. Univ., Coral Gables, Fla.

NEGATIVE PION INTERACTIONS AT 1.3 Bev/C. M. Blau, C. F. Carter, and A. Perlmutter. July 10, 1959. 36p. Contract AF-49(638)-97.

A total of 340 meters of track of negative pions of momentum 1.3 Bev/C have been followed in emulsion, and pion interactions have been recorded. Special emphasis is placed on inelastic scattering on free protons (single meson production). The resulting angular and momentum distributions of the emitted particles are investigated and compared with previous experiments at similar energies. An attempt is made to explain these results on the basis of an isobar decaying into a nucleon and the slower pion. In the case of reaction $\pi^- + p \rightarrow \pi^- + \pi^0 + p$, it appears that there exists an anisotropy in the isobar frame of reference, in which the slower pion is emitted predominantly backward, with respect to the isobar direction. The results are compared with the $\pi-\pi$ coupling model. Angular and energy distributions of mesons emitted in nuclear interactions are investigated and compared with other results and Monte Carlo calculations. The meson multiplicity and energy degradation in these collisions are also discussed. Strange particles found during the investigation are analyzed. (auth)

19603 BAW-TM-203

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

GEOMETRIC AND TEMPERATURE EFFECTS IN THORIUM RESONANCE CAPTURE. W. G. Pettus. Apr. 27, 1959. 20p.

An experiment was performed in an effort to reduce the uncertainty in thorium resonance absorption and in particular to verify and extend the results of previous measurements of the geometric and temperature dependence of thorium resonance integrals. The experiment was carried out by the reactivity coefficient method. The results of the investigation of the geometric dependence are in reasonable agreement with previous measurements for Th but not for ThO_2. The temperature dependence results are consistent with the previous measurements. (W.D.M.)

19604 CF-59-8-24

Oak Ridge National Lab., Tenn.

CALCULATION OF TRANSPORT CROSS SECTIONS.

C. W. Nestor. Aug. 5, 1959. 5p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Many elements exhibit anisotropic scattering at energies of interest in reactor calculations. A method is presented for the calculation of transport cross sections including the observed anisotropy. (auth)

19605 GAT-265

Goodyear Atomic Corp., Portsmouth, Ohio.

THE REACTION OF URANIUM DIOXIDE WITH URANIUM HEXAFLUORIDE. G. A. Rampy. June 5, 1959. 30p. Contract AT(33-2)-1. $1.00(OTS).

The reaction of uranium dioxide with uranium hexafluoride in a quasi-static system has been investigated in the temperature range 25 to 500°C. Although the products of the reaction at 500°C are uranyl fluoride and uranium tetrafluoride, the data indicate that the reaction mechanism is extremely complex, involving little-known uranium compounds. While these compounds have not been identified or isolated, their presence is deduced from visual observations, weight change and wet chemical and isotopic analyses. A mechanism for the reaction has been proposed which is in agreement with the observed data. This mechanism is not intended as a rigorous representation of the reaction, but rather as an illustration of the experimental results. The reaction of uranium dioxide with uranium hexafluoride apparently proceeds through the formation of a pentavalent oxyfluoride which subsequently undergoes further reaction with the hexafluoride, forming another unstable pentavalent oxyfluoride. (auth)

19606 INSJ-16

Tokyo Univ. Inst. for Nuclear Study.

SPIN-ORBIT COUPLING AND TENSOR FORCES. B. Jancovici. June 20, 1959. 17p.

The possible explanation of the spin-orbit coupling, in heavy nuclei, by second-order effects of the tensor forces is investigated. The various second order terms are described by 4 graphs, in the case of one particle outside closed shells. The main contribution comes from an exclusion effect: two particles of the closed shells cannot, by mutual excitation, jump into the orbit which is already occupied by the outside particle. This effect could account, at least partially, for the observed spin-orbit splitting. The case of a hole is also investigated and shows the same kind of agreement. A comparison with other works is discussed. (auth)

19607 NP-7768

Naval Postgraduate School, Monterey, Calif.

RESONANCES IN THE CAPTURE OF PROTONS BY NATURAL SILICON (thesis). Robert A. Close and Paul V. Converse. 1957. 38p.

The resonances in the capture of protons by natural silicon were investigated over the range of proton energies from 0.19 to 2.0 Mev. A study of the range from 1.57 to 1.8 Mev revealed prominent resonances at 1.616 and 1.648 Mev with lesser resonances at 1.702, 1.725, 1.774, and 1.818 Mev. Possible resonances were observed in this range at proton energies of 1.582, 1.596, 1.608, 1.633, 1.658, 1.747, and 1.795 Mev. The particular isotope of silicon causing each resonance was not established. (auth)

19608 NP-7812

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

ANALYSIS OF THE INFLUENCE OF LOW ENERGY PENETRATING PHOTONS ON THE ABSORPTION OF EXTENSIVE AIR SHOWERS IN LEAD. Report No. 78/VI. J. Babecki. Apr. 1959. 11p.

Experimental absorption curves were obtained from which the mean number of penetrating photons leaving the absorber during one act of coincidence and the number of these photons per electron striking the absorber were calculated for various thicknesses of lead. The coefficient of absorption was found for the photons under study and the value agreed with the theoretical value for an energy of 1.2 to 7 Mev. (W.D.M.)

19609 NP-7813

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

SCATTERING OF SLOW NEUTRONS BY MOLECULES OF LIQUID WATER, AMMONIA AND HYDROGEN SULPHIDE. Report No. 74/II. A. Wanic. Mar. 1959. 14p.

Cross section measurements were made on H_2O, NH_3, and H_2S and compared with the theory of Krieger and Nelkin. A Ra-Be source was used for introductory measurements, but measurements were eventually made in the Polish EWA Reactor. The results indicate that the molecular cross sections measurements are higher than the calculated ones, possibly because of hindrance of molecular rotation. (T.R.H.)

19610 ORO-207

Vanderbilt Univ., Nashville and Western Reserve Univ., Cleveland.

A STUDY OF POST-ACCELERATION AND OF WEAK CONVERSION LINES IN SAMARIUM-151 AND TIN-113 (thesis). William T. Achor. Jan. 1958. 133p. Contracts AT(40-1)-268 and AF18(603)-61. $21.30(ph), $6.90(mf) OTS.

Submitted to Vanderbilt Univ.

A study of post-acceleration was made to gain new information about the limitations and possibilities of this method for facilitating the study of low energy electron spectra. The electron spectrum of the decay $Sm^{151} \rightarrow Eu^{151}$ was measured with the lens spectrometer and the photon spectrum with a scintillation spectrometer. Selected regions of the conversion electron spectrum from the decay $Sn^{113} \rightarrow In^{113}$ were studied with the lens spectrometer. A weak conversion line arising from a transition of energy 253 ± 4 kev was found. (W.D.M.)

19611 UCRL-8753

California. Univ., Berkeley. Lawrence Radiation Lab.

SCATTERING OF K^+ MESONS OFF PROTONS (thesis). Thaddeus Francis Kycia. May 14, 1959. 81p. Contract W-7405-eng-48. $2.25(OTS).

The total K^+-p cross section was measured at the three K^+-meson energies 175 ± 25, 225 ± 25, and 275 ± 25 Mev and the differential scattering cross section was measured at 225 Mev. The K^+-p nuclear force was shown to be repulsive from the observed constructive interference with Coulomb scattering. The differential cross section was otherwise isotropic and could arise from either pure S-wave or pure P-wave scattering. Subtracted dispersion relations were applied to these data and the rest of the available K proton scattering data. The statistical errors on the data were found to be too large to determine the K-hyperon relative parity. However, if the KΛ and KΣ relative parities are assumed to be the same, then if the coupling were scalar, the coupling constant $g^2/4\pi$ would be less than 0.6; if pseudoscalar, less than 10. (auth)

19612 UCRL-8780

California. Univ., Berkeley. Lawrence Radiation Lab.

NUCLEAR REACTIONS OF LOW-Z ELEMENTS WITH

5.7-BEV PROTONS; NUCLEAR STRUCTURE AND SIMPLE NUCLEAR REACTIONS (thesis). Paul A. Benioff. July 1959. 141p. Contract W-7405-eng-48. $2.75(OTS).

The results of 5.7-Bev proton bombardments of the target elements Be, C, N, O, F, Na, and Al are described. Production cross sections were obtained for many radioactive products with half lives between 1.2 minutes and 12 years. The p,pn cross sections for the targets C, N, O, F, and Na were found to be 29 ± 3, 7.3 ± 0.7, 33 ± 5, 19 ± 2, and 31 ± 5 mb, respectively. Much of the variation in these values is shown to be due to the difference in the number of neutrons available for p,pn reactions in the different target nuclei. The cross sections for other types of reactions studied do not change as much over the range of target elements studied as do the p,pn cross sections. Extension of the excitation functions for the reactions studied up to 5.7 Bev shows that the cross sections seem to be fairly constant between 1 to 3 Bev and 5.7 Bev. A theory is developed to describe the observed magnitude and variation of the cross sections for simple nuclear reactions as exemplified by the p,pn reaction. At multi-Bev energies to which this treatment is restricted, the main contribution to the p,pn-reaction cross section comes from inelastic collisions between the incident protons and target neutrons, with all the p-n collision products escaping without further interaction. (auth)

19613 CEA-tr-R-155

REACTION (d,p) POUR NOYAUX LOURDS. ((d,p) Reaction for Heavy Nuclei.) K. A. Ter-Martirosyan (Ter-Martirossian). Translated into French by B. de Trezvinsky from Zhur. Eksptl'. i Teoret. Fiz. 29, 713-29(1955). 46p. (Includes original, 17p.)

Calculations were made of the differential cross section of the (d,p) reaction on a heavy nucleus, in the case where the Coulomb field effect is a fundamental factor which determines the angular distribution. The differential cross section, in the large-angle region, increases with increasing angle; furthermore the variation of the cross section with the angle depends weakly on the l_n moment of the state in which the neutron is captured. The total cross section is determined as an estimate of the pre-exponential multiplier. (tr-auth)

19614

ON THE EXCITED LEVELS OF Pt^{192}. L. Keszthelyi and J. Zimányi (Central Research Inst. of Physics, Budapest). Acta Phys. Acad. Sci. Hung. 10, 1-6(1959).

The 784-kev energy level of Pt^{192} decays partly by 468-kev E2 radiation into the 316-kev excited level, partly by 784-kev E4 radiation into the ground state. It follows from the high intensity of the crossover that the 468-kev transition has to slow down in about 10^{-5} sec. According to the coincidence measurements the life time of the 468-kev transition is $\tau < = 2.10^{-8}$ sec. By scintillation spectrometer measurements of the high-energy part of the Pt^{192} spectrum the relative intensity of the 784-kev radiation has been obtained as $< 0.5 \times 10^{-2}$ (in terms of the intensity of the 600-kev line). From the coincidence measurements it seems probable that the intensity of the 784-kev E4 transition is less by 3 orders of magnitude than the above value. The existence of the 1050 and 1210 kev lines has been verified by the measurements. (auth)

19615

ELECTRON SCATTERING CROSS SECTIONS WITH RELATIVISTIC CORRECTION IN THE FIRST BORN APPROXIMATION FOR THOMAS-FERMI AND HARTREE POTENTIALS. T. Tietz (University, Lodz, Poland). Acta Phys. Acad. Sci. Hung. 10, 19-27(1959).

The electron scattering cross sections which include the effect due to relativity in the first Born approximation for Thomas-Fermi and Hartree potentials are calculated. The Thomas-Fermi potential and the Hartree potentials are approximated by analytical fits. The results show that the electron scattering cross sections without relativistic correction agree quite well with the numerical results of the exact Thomas-Fermi potential. A comparison of electron scattering cross sections for approximate Thomas-Fermi and approximate Hartree potentials with the exact numerical data calculated from Hartree fields for argon is given. The analytical fits for Hartree fields do not differ essentially from the fits for Thomas-Fermi potential. Nineteen fits of Hartree potentials for neutral atoms are given. An analytical approximate formula for the electron scattering total cross section which includes relativistic correction is derived. Several numerical data for the electron scattering total cross section without the relativistic correction for argon for the Thomas-Fermi and Hartree potential are contained. (auth)

19616

THE STATISTICAL MODEL OF NUCLEI WITH ANGULAR MOMENTUM. D. Kisdi (Hungarian Academy of Sciences, Budapest). Acta Phys. Acad. Sci. Hung. 10, 29-38(1959).

The statistical model is extended to the investigation of nuclei with angular momentum. The critical angular momentum is determined as the function of the mass number. (auth)

19617

CONNECTION BETWEEN THE ISOROTATOR MODEL OF THE HOT PARTICLES AND THE D'ESPAGNAT-PRENTKI THEORY. G. Pőcsik (Roland Eötvös Univ., Budapest). Acta Phys. Acad. Sci. Hung. 10, 121-3 (1959).

This paper deals with the connection between the screw model of the hot particles in isobaric spin space and the D'Espagnat-Prentki theory. The theory says nothing about the rest mass of the elementary particle, while Rayski's theory leads in a very simple way to the mass quantization, though there are some arbitrary features in his model. It seems expedient to combine the positive properties of these theories. Rayski, however, provides the field quantity of the isorotator with two isospin indices corresponding to the isobaric spins of the two points. Fortunately, it can be shown that the eigenfunctions of the mass operator with respect to the rotations and inversions in isobaric spin space (u-space) transform as the D'Espagnat-Prentki's field quantities. This means a close connection between the two theories. In the proof use is made of the fact that the mass eigenequation must be covariant with respect to the rotations and inversions in u-space, which is very natural from the physical point of view. (auth)

19618

SATURATION OF NUCLEAR FORCES. Witlof Brunner (Deutschen Akademie der Wissenschaften, Berlin). Ann. Physik 3, 233-40(1959). (In German)

A discussion is presented on whether repelling many-body forces are necessary for the stabilization of the nucleus or whether the saturation character of the nuclear force can be explained only by the assumption

of "hard cores" for the nucleons. It could be shown that the approximation representation of W. Macke (Ann. Physik 19, 89(1956)) for the calculation of the total energy of a nucleus leads to an undervaluation of the kinetic energy and therefore gives a nuclear density which is too large. An improved representation of the kinetic energy produces a density reduced by approximately a factor of 10. Therefore, the introduction of repelling many-body forces does not appear so necessary to the stabilization of nuclear matter as had been assumed. (tr-auth)

19619

ON THE DEFORMABILITY OF THE NUCLEAR CORE. Z. Szymański (Warsaw Univ. and Inst. for Nuclear Research, Warsaw). Bull. acad. polon. sci., Ser. sci., math., astron. et phys. 7, 233-6(1959).

It is shown that the deformability calculated for the square-well potential is larger than that for the harmonic oscillator. The latter is thus more resistant to deformation. The square-well deformability γ decreases on the average for the increasing nucleon number. For heavy nuclei ($A \sim 200$) the calculated deformability γ is somewhat larger than the experimental value. This is connected with the fact that the real nuclear potential deviates from the pure square-well shape. (auth)

19620

ISOTOPES OF MERCURY AND GOLD WITH MASS NUMBER 190. Georgette Albouy, René Bernas, Mark Gusakow, Nine Poffé, and Jean Teillac (Laboratoire de Physique Nucléaire, Orsay, France). Compt. rend. 249, 407-9(1959) July 20. (In French)

In a study of Au(p,xn) reactions, the mercury isotope with mass number 190 was detected and separated by double deflection. The mass number was verified, and the decay of Hg^{190} and of its daughter Au^{190} was studied by following the evolution of the K radiation accompanying electron capture. Two periods of 21 ± 2 min and 45 ± 3 min were observed and assigned to Hg^{190} and Au^{190}, respectively. The gamma radiation and the relative intensities are tabulated for both periods. (J.S.R.)

19621

DECAY SCHEME OF THE LONG-LIVED ISOMER OF TECHNETIUM-95. Christiane Lévi, Lily Papineau, Claudine Latapie-Redon, and Noëlle Saunier (Centre d'Études Nucléaires, Saclay, France). Compt. rend. 249, 410-12(1959) July 20. (In French)

The decay scheme of 60-day Tc^{95} was determined by a study of the γ-γ and β-γ coincidences, γ-γ angular correlations, and gamma conversion coefficients. The branching ratios of the different transitions and the spins of Mo^{95} levels from the decay of Tc^{95} were determined. The measurement results are tabulated, and the decay scheme is given. (tr-auth)

19622

CHARACTERISTICS OF THE LEVELS EXCITED DURING CAPTURE OF INTERMEDIATE ENERGY NEUTRONS BY TUNGSTEN AND PLATINUM. Charles Corge, Vinh-Kinh Huynh, Jean Julien, Shamin Mirz, Francis Netter, and Jovan Simic (Centre d'Études Nucléaires, Saclay, France). Compt. rend. 249, 413-15 (1959) July 20. (In French)

The time-of-flight method was used to study the levels of the compound nuclei W^{184} and Pt^{196} excited by neutrons of intermediate energy. The levels for which the spin $J = 1$ are tabulated. The average interval between levels is $\overline{D} = 27.5$ ev for tungsten and $\overline{D} = 41$ ev for platinum. The measurement of the total cross sections was made and the resonances observed are tabulated. The average interval for these levels has the same value for both tungsten and platinum, $\overline{D} = 10$ ev. (J.S.R.)

19623

THE FINE STRUCTURE OF THE ENERGY SPECTRUM OF PHOTOPROTONS FROM Ca^{40}. A. P. Komar and T. N. Dragnev (Kalinin Leningrad Polytechnic Inst.). Doklady Akad. Nauk S.S.S.R. 126, 1234-5(1959) June 21. (In Russian)

The energy and angular distributions of photoprotons from Ca^{40} were measured by means of 200-μ thick NIKFI-22 emulsion. The 8.4 mg/cm^2 Ca plate was irradiated by γ rays from a synchrotron with maximum energy 85 Mev. The photoplates were distributed in a vacuum chamber at 20, 40, 60, 70, 80, 90, 100, 110, 120, 140, and 160° in relation to the γ-ray direction. Over 7000 photoproton tracks were measured. The angular distribution at various energies was developed by the method of least squares, and a histogram was plotted. (R.V.J.)

19624

EVALUATION OF THE VOLUME OF A POINT OF FISSION IN URANIUM. Y. Quéré and F. Nakache (Centre d'Etudes Nucléaires, Saclay, France). J. Nuclear Materials 1, 203-9(1959) July. (In French)

The number of lattice defects formed in uranium by neutron irradiation shows a rapid saturation which can be demonstrated by electrical conductivity measurements. This saturation arises from the existence of a region of intense thermal agitation, the "fission spike," associated with each fission. In this region pre-existing defects are annihilated. A diminution of defects at the temperature of irradiation (room temperature) is superimposed on this effect. It is possible to disentangle these two effects and determine that the volume of the "fission spike" is 2.10×10^{-16} cm^3 ± 0.20×10^{-16} cm^3. (auth)

19625

A FURTHER STUDY OF THE DECAY OF Ir^{192}. József Mráz. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 338-43(1957) May-June. (In Hungarian)

The angular correlation of 308-316, 308-296, 296-316 kev gamma cascades in the radiations of Pt^{192} were measured to remove the ambiguities in the spin assigned to the fourth excited level of Pt^{192}. In the discussion an interpretation of the excited levels of Pt^{192} is given. (auth)

19626

(γ,ρ) REACTIONS IN POTASSIUM. PRELIMINARY REPORT. János Erő and Lajos Keszthelyi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 428-35(1957) July-Aug. (In Hungarian)

The energy spectrum of protons produced in a thin KI crystal by gamma radiation from the Li(ρ,γ) reaction was measured. The distribution in the high energy part of the spectrum differs from that given by the statistical model. (auth)

19627

ENERGY DISTRIBUTION OF EVAPORATING CHARGED PARTICLES. Judit Németh. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 436-41 (1957) July-Aug. (In Hungarian)

Theoretically the charged particles evaporating from an excited nucleus can only escape at energies exceeding

that of the coulomb barrier. Experimentally, however, they are observed to leave at smaller energies too. Considering the vibration state of a nucleus when emitting particles, even theoretically, the evaporating particles are expected to have lower threshold energies in the laboratory system. (auth)

19628

NOTE ON THE TRANSITIONS FROM THE EXCITED LEVELS OF Pt^{192}. Lajos Keszthelyi and József [Mráz] Zimanyi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 5, 495-501(1957) Sept.-Oct. (In Hungarian)

The 784 kev energy level of Pt^{192} decays partly by 468 kev E2 radiation into the 314 kev excited level, partly by 784 kev E4 radiation into the ground state. It follows from the high intensity of the crossover that the 468 kev transition has to slow down to about 10^{-5} sec. According to $\beta-\gamma$ coincidence measurements the life time of the 468 kev transition is $\tau < 2.10^{-8}$ sec. By scintillation spectrometer measurements of the high energy part of the Pt^{192} spectrum, the relative intensity of the 784 kev radiation was obtained as $< 0.5 \times 10^{-2}$ (in terms of the intensity of the 600 kev lines). From the coincidence measurements it seems probable that the intensity of the 784 kev E4 transition is by 3 orders of magnitude lower than the above value. The existence of the 1050 and 1210 kev lines was verified by the measurement. (auth)

19629

THE MECHANISM OF THE DIRECT INTERACTION PROCESS AT INTERMEDIATE ENERGIES. R. J. Griffiths and R. M. Eisberg (Univ. of Minnesota, Minneaplis). Nuclear Phys. 12, 225-36(1959) July (2).

At intermediate energies, most inelastic proton scattering reactions are due to non-compound nucleus processes which are called direct interactions. Several mechanisms for direct interactions were suggested such as nucleon-nucleon collisions in the diffuse surface of the nucleus, nucleon-nucleon collisions occurring throughout the nucleus, and direct excitation of low-lying rotational states. Each of these appears to be capable of explaining the experimental data currently available (the energy and angular distribution of single inelastically scattered protons). To obtain additional data for the purpose of distinguishing between these mechanisms, measurements of the angular correlation of proton pairs emitted in direct interactions were made. Using large solid angle plastic scintillation counters, and coincidence resolving times of ten millimicroseconds, measurements were made on the angular correlation in the range of separation angles 40 to 105°. The energy of the bombarding protons was 40 Mev. Cu, Ni, and Pb were used as targets. The results of the experiment indicate that the first listed mechanism is predominant at these energies, and that the momentum of the struck nucleon is significantly lower than was observed in experiments which measure the momentum distribution of nucleons which may be located anywhere within the nucleus. (auth)

19630

PROTON TOTAL REACTION CROSS SECTIONS AT 34 MeV. T. J. Gooding (Univ. of Minnesota, Minneapolis). Nuclear Phys. 12, 241-8(1959) July (2).

Proton total reaction cross-sections were measured for five elements at 34 ± 2.5 Mev. Attenuation measurements were made with a dE/dxtelescope and a biased E counter, in poor geometry. Corrections for elastic and inelastic scattering were determined experimentally. The results were compared with optical model analysis to select sets of parameters fitting the elastic scattering angular distributions equally well. For carbon the measurements favor the solution with the smaller radius constant. For the other elements the optical model predictions are in good over-all agreement but further analysis is required. (auth)

19631

THE MULTIPLE SCATTERING OF NEUTRONS AT RESONANCES. T. J. Kennett and L. M. Bollinger (Argonne National Lab., Lemont, Ill.). Nuclear Phys. 12, 249-60(1959) July (2).

The effects of multiple scattering of neutrons at resonances were investigated experimentally and by means of a Monte Carlo calculation. Multiple scattering in thick samples produces a peculiar distribution in the time-of-flight spectrum, the characteristics of which were reproduced by computation. The results of this investigation show that quantitative information about partial cross sections is of questionable value when multiple scattering is an important factor. (auth)

19632

THERMAL NEUTRON CROSS-SECTIONS FOR PRODUCING SOME ISOMERS. M. L. Sehgal, H. S. Hans, and P. S. Gill (Muslim Univ., Aligarh, India). Nuclear Phys. 12, 261-8(1959) July (2).

Thermal neutron cross-sections were measured for use in production of isomers. The Swimming Pool reactor at Trombay, Bombay, was used. The cross-sections for the reactions $Pd^{108}(n, \gamma)Pd^{109m}$, $Pd^{110}(n, \gamma)Pd^{111m}$, $Sb^{121}(n, \gamma)Sb^{122m}$, $Nd^{150}(n, \gamma)Nd^{151}$, $Dy^{158}(n, \gamma)Dy^{159}$, $Hg^{196}(n, \gamma)Hg^{197m}$, $Hg^{196}(n, \gamma)Hg^{197}$, and $Hg^{198}(n, \gamma)Hg^{199m}$ were measured using scintillation techniques. (auth)

19633

MOMENTUM DISTRIBUTION OF NUCLEONS IN THE NUCLEAR SURFACE. I. E. McCarthy, E. V. Jezak, and A. J. Kromminga (Univ. of Minnesota, Minneapolis). Nuclear Phys. 12, 274-90(1959) July (2).

The results of the 40-Mev (p, 2p) experiments of Griffiths and Eisberg are analyzed on the basis of a model for the total momentum transfer. Assuming two-body collisions and the impulse approximation and representing the momentum distribution of bound protons by a Fermi distribution whose maximum momentum is p_f, it is almost certain that 0.5 Mev $< p_f^2/2m <$ 1.5 Mev. Assuming a semiclassical model for the reaction, it is shown that the events observed in this experiment occur in the extreme nuclear surface. Thus the experiment is strong evidence in support of the Thomas-Fermi approximation for nucleons in a finite nucleus. Representing the main bulk of the nucleus by an absorbing sphere, it is shown that the observed ratio of (p, 2p) to (p, p') events is consistent with the assumption that direct interactions all proceed from an initial two-body collision. (auth)

19634

TOTAL NEUTRON CROSS SECTIONS OF THE HYDROGEN AND HELIUM ISOTOPES. J. H. Coon (Los Alamos Scientific Lab., N. Mex.). Nuclear Phys. 12, 291-7 (1959) July (2).

Experimental total neutron cross section data are reported for H^3 and He^3 at 0.2 to 20 Mev, for He^4 at 1 to 15 Mev, and for H^1 and H^3 at 14.10 Mev. Interesting comparisons are made with the theoretical calculations

reported by Bransden, Robertson, and Swan for H^3 and He^3. (auth)

19635

(α,d) REACTIONS ON N^{14} AND Li^6. B. Zeidman and J. L. Yntema (Argonne National Lab., Lemont, Ill.). Nuclear Phys. 12, 298-304(1959) July (2).

Angular distributions of the emergent deuterons from the reactions $Li^6(\alpha, d)Be^8$ and $N^{14}(\alpha, d)O^{15}$ were obtained for an incident alpha-particle energy of 43 Mev. The experiment was performed in the 60-in. scattering chamber, the deuterons being selected by a system employing a double NaI(Tl) crystal detector. The distributions, which cover the angular range between approximately 15 and 90° in the center-of-mass system, exhibit oscillatory behavior and forward peaking. Attempts to fit the data were made. In the case of N^{14} a satisfactory fit can be obtained using spherical Bessel functions. Inclusion of some heavy-particle stripping improves the fit to the data. In the case of Li^6 it was not possible to obtain a satisfactory fit. (auth)

19636

HEAVY NUCLIDE CROSS SECTIONS OF PARTICULAR INTEREST TO THERMAL REACTOR OPERATION: CONVENTIONS, MEASUREMENTS AND PREFERRED VALUES. R. W. Stoughton and J. Halperin (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 6, 100-18 (1959) Aug.

The various conventions and definitions of thermal and resonance flux are discussed. Measurements of the thermal neutron cross sections, resonance integrals, and reactor cross sections of the following nuclides are critically reviewed: Th^{232}, Th^{233}, Pa^{233}, U^{233}, U^{234}, U^{235}, U^{236}, U^{238}, U^{239}, Np^{239}, Pu^{239}, Pu^{240}, Pu^{241}, and Pu^{242}. (auth)

19637

HOW GOOD IS THE EXPONENTIAL LAW IN α DECAY? Joachim Petzold (Universität, Munich). Z. Physik 155, 422-32(1959). (In German)

A particle in a penetrable sphere is treated as a simple model of α decay, and the time behavior of the wave function is discussed. The deviations from the exponential law for very small and for very large times cannot be experimentally observed. (auth)

19638

THE PARTIAL BETA SPECTRA OF Dy^{165}. F. Bonhoeffer, H.-H. Hennies, and A. Flammersfeld (Universität, Göttingen, Ger.). Z. Physik 155, 488-97(1959). (In German).

The gamma spectrum from the decay of 2.3-hr Dy^{165} was measured with a scintillation spectrometer. In addition to the lines already known at 92, 275, 356, 630, 708, and 985 kev, an additional line at 555 ± 5 kev was found. By β-γ coincidences the transitions to the 95- and 985-kev levels were investigated. The measurement of the β spectra was made with an anthracene split crystal, which was surrounded by a NaI crystal, in order to register the γ quanta used for the coincidence. The form of both beta spectra was determined, and the Fermi diagrams show in each case a straight-line path. The values 1.215 ± 0.020 and 0.305 ± 0.010 Mev were obtained for the maximum energy. The maximum energy for the β transition to the ground level of Ho^{165} was 1.305 ± 0.020 Mev. From β-γ coincidence measurements and the intensity ratios of the γ spectra it was shown that in the decay of Dy^{165} 80% leads to the ground level of Ho^{165}, 16% to the 95-kev level, and approximately 2% to the 985-kev level. (tr-auth)

19639

CORRECTIONS TO THE V. M. STRUTINSKII ARTICLE ON EXCITATION OF ROTATIONAL STATES IN α DECAY OF EVEN-EVEN NUCLEI. V. M. Strutinskii. Zhur. Eksptl'. i Teoret. Fiz. 36, 1957(1959) June. (In Russian)

Corrections to the calculation of parameters of even-even α nuclei deformation in relation to the relative intensity of the α decay to the $2^+(\xi_2)$ state are given. The consequent daughter nuclei ξ_2 (exp) are indicated, and the negative values of α are given for the cases when they agree with the distribution of the intensities. (R.V.J.)

19640

THE INTERDEPENDENCE OF SOLID STATE PHYSICS AND ANGULAR DISTRIBUTION OF NUCLEAR RADIATIONS. Ernst Heer and Theodore B. Novey (Univ. of Rochester, N. Y. and Argonne National Lab., Lemont, Ill.). p.199-255 of "Solid State Physics. Advances in Research and Applications. Volume 9." Frederick Seitz and David Turnbull, eds. New York, Academic Press, 1959. 559p.

The necessary formalism connected with the field-free angular correlation problem is summarized, and the effects of various types of fields likely to be encountered are examined. Special topics, experimental techniques, and angular distributions of nuclear radiations as a tool in solid-state physics are discussed. (W.D.M.)

19641

EXPERIMENTAL NUCLEAR PHYSICS. VOLUME II. E. Serge, ed., P. Morrison and B. T. Feld. New York, John Wiley and Sons, Inc., 1953. 605p.

Volume II of three volumes on nuclear physics intended for the practicing nuclear physicist is presented. Nuclear reactions and the neutron are considered. (W.D.M.)

Theory

19642 NEVIS-50

Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs.

CONSERVATION LAWS IN WEAK INTERACTIONS. T. D. Lee. Mar. 1957. 61p. Contracts N6-ori-110, Task No. 1 and AT(30-1)-1932. (CU-145-57-ONR-110-Phys). $10.80(ph), $3.90(mf) OTS.

Notes are presented on four lectures given at Harvard University in March 1957 on elementary particle physics, the $\theta-\tau$ problem, validity of parity conservation, tests for invariance under P, C, and T, and the two component theory of the neutrino. (W.D.M.)

19643 NP-7792

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.

SPECTRAL REPRESENTATIONS FOR SOME VERTEX PARTS. I. T. Todorov and O. A. Khrustalev. 1959. 15p.

Dispersion relations (spectral representations) for the amplitudes describing the decay of K-mesons and hyperons into two strongly interacting particles are derived. The singular integral equations for the amplitudes obtained in the "single-meson" approximation are solved by the method suggested by Muskhelishvili. (auth)

19644 NP-7800
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
A TENTATIVE EXPLANATION OF SMALL DEVIATIONS OBSERVED IN BETA SPECTRA. Report No. 94/VII. B. Kuchowicz. June 1959. 10p.

The small deviations in beta spectra previously observed experimentally could have been linearized only by introducing an empirical Fierz-like correction term with the same sign for electron and positron spectra. Terms of this type are obtained under the simple assumption of a semiphenomenological nature. As the A-T interference in Gamow-Teller transitions is now considered to be rather impossible, only the supposition is left that the experimental phenomena may be explained by the suppression of the usually dominant matrix elements. The scheme considered is based on Gell-Mann's ideas. It is possible to calculate some new terms in the e-ν angular correlation, polarization formulas, etc., however, the intricate form of the expressions involved seems to render hardly possible any definite conclusions. (auth)

19645 NP-7805
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
AN APPROXIMATION METHOD FOR SOLVING SCATTERING PROBLEMS. Report No. 87/VII. A. Krzywicki. May 1959. 9p.

A relativistic approximation method for solving scattering problems is discussed. The method can be useful in processes involving strongly interacting particles, where the use of a perturbation method is forbidden by the high value of the coupling constant. Considerations are limited to the spinor field interacting with a pseudoscalar field. (W.D.M.)

19646 SCR-67
Illinois. Univ., Urbana.
RELATIVISTIC HYDRODYNAMICS. A. H. Taub. Mar. 1959. 19p. $0.75(OTS).

A Lecture delivered at Sandia Corp., Albuquerque, N. Mex., February 7, 1958.

Lecture notes on a classical theory of relativistic hydrodynamics are presented. (C.J.G.)

19647
A SIX-DIMENSIONAL INTERPRETATION OF NUCLEAR FORCES. J. Rayski (Univ. of Krakow). Bull. acad. polon. sci., Ser. sci., math., astron. et phys. 7, 251-4 (1959).

19648
μ-MESON DECAY AND THE NONCONSERVATION OF PARITY. B. Jakšić and J. Šoln (Faculty of Science, Zagreb and Institute "Ruđer Bošković," Zagreb). Glasnik mat.-fiz. i Astron., Ser. II 13, 125-35(1958).

The non-conservation of parity in μ-meson decay having been established, the problem of determining the type of interaction between the μ-meson, the electron, and the neutrino arises. A calculation of the polarization of the electron is given assuming the most general Fermi interaction without derivatives. (T.R.H.)

19649
RADIATIVE CORRECTION TO ELECTRON MASS IN NON-LINEAR ELECTRODYNAMICS. V. Yu. Urbakh (Inst. of Biophysics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 37, 295-6(1959) July. (In Russian)

A wave solution for field equations corresponding to non-linear lagrangians must be found in order to calculate the radiative quantum corrections in electron mass conditioned by the interaction of quiescent electrons with photons and electron-positron backgrounds. However, the above condition cannot be fulfilled due to mathematical difficulties; consequently, an attempt is made to find an approximate, preliminary estimate of the magnitude of the radiative quantum corrections. (R.V.J.)

19650
THEORY OF RESONANCE REACTIONS AND ALLIED TOPICS. Gregory Breit (Yale Univ., New Haven). p.1-407 of "Handbuch der Physik. Band XLI/1. Kernreaktionen II: Theorie." (Encyclopedia of Physics. Volume XLI/1. Nuclear Reactions II: Theory). S. Flugge, ed. Berlin, Springer-Verlag, 1959. 586p.

A review of the theory of resonance reactions is presented. Topics discussed include resonances for central scattering, channels and scattering matrix, schematic model of many-channel reactions, effect of gamma emission, many-particle features, and the Wigner development. (W.D.M.)

19651
COULOMB WAVES FUNCTIONS. McAllister Hobert Hull, Jr. and Gregory Breit (Yale Univ., New Haven). p.408-65 of "Handbuch der Physik. Band XLI/1. Kernreaktionen II: Theorie." (Encyclopedia of Physics. Volume XLI/1. Nuclear Reactions II: Theory). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 586p.

Fundamental properties and relations for Coulomb wave functions are considered. Attention is restricted to nonrelativistic energies. Bessel function expansions, asymptotic forms and expansions, approximate expressions, methods of calculation, and tables of Coulomb functions are given. (W.D.M.)

19652
COULOMB EXCITATION. Gregory Breit and Robert L. Gluckstern (Yale Univ., New Haven). p.496-560 of "Handbuch der Physik. Band XLI/1. Kernreaktionen II: Theorie." (Encyclopedia of Physics. Volume XLI/1. Nuclear Reactions II: Theory). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 586p.

The electromagnetic field of a charged particle falls off with distance more slowly than the specifically nuclear forces and is thus capable of raising a target nucleus from its ground level to a higher one at bombarding energies which are so low as to make reactions taking place by other mechanisms entirely negligible. Under these conditions it is customary to refer to the excitation which takes place as Coulomb excitation. Correspondence principle considerations, semi-classical first-order theory, quantum-mechanical first-order theory, radial matrix elements, dipole excitation, comparison of quantum and semi-classical theories, higher order effects, and limitations of the theory are discussed. (W.D.M.)

RADIATION EFFECTS ON MATERIALS

19653 HW-60326
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE EFFECTS OF LOW NEUTRON EXPOSURES AT

LOW TEMPERATURES ON THE HARDNESS AND TENSILE PROPERTIES OF NATURAL URANIUM. A. L. Bement. June 2, 1959. 64p. Contract W-31-109-Eng-52. $1.75(OTS).

Techniques for conducting low-exposure neutron irradiations of natural uranium at temperatures below 35°C are described. Tensile specimens were irradiated under these conditions to four exposure levels, the highest of which was 6.6×10^{17} nvt. Hardness and tensile tests were conducted. A significant increase in Rockwell hardness occurred between 2.9×10^{15} and 4.8×10^{16} nvt. An exposure of 6.6×10^{17} nvt effected a 90% increase in yield strength and a 60% decrease in unit elongation with respect to the unirradiated values. Irradiated specimens were annealed at 200, 300, and 400°C for 10 and 25 hr, following which hardness and tensile properties were measured to determine the extent of recovery. Essentially complete recovery occurred at 300°C for all exposures except 6.6×10^{17} nvt which required a 400°C anneal to recover unirradiated property values. Hardening and recovery mechanisms are discussed. Microstress recovery observed by other investigators during irradiation at temperatures above 100°C was not observed. Assuming a vacancy diffusion process for recovery, the temperature at which vacancies become mobile in uranium is proposed to lie between 35 and 150°C. (auth)

19654 NP-7825

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST NO. 26 [ON RADIATION EFFECTS DATA]. Aug. 15, 1959. 25p. Project No. 2133. Contract AF33(616)-5171.

19655 NYO-7500

Pennsylvania State Univ., University Park.

EFFECT OF RADIATION ON DYNAMIC PROPERTIES OF HIGH POLYMERS. Progress Report Covering Period July 1, 1958 to June 30, 1959. J. A. Sauer. July 1, 1959. 24p. Contract AT(30-1)-1858. $3.30(ph), $2.40 (mf) OTS.

Progress made during the year is briefly summarized. Theoretical studies involving the rate of energy deposition in polyethylene by various mechanisms, the effect of various types of irradiation on the crystallinity of polyethylene, and the propagation of pulses in rods are described. Mention is also made of new work on hydrated and deuterated nylon, on low temperature studies between 4 and 80°K, on gel measurements of polypropylene irradiated at various temperatures, and on some of the various ways and means now being used to extend the frequency range of the dynamic mechanical measurements. (For preceding period see NYO-7499.) (auth)

19656 USNRDL-TR-325

Naval Radiological Defense Lab., San Francisco.

RADIATION-INDUCED CURRENTS IN SOLID ORGANIC INSULATORS. J. W. Winslow and R. S. Alger. May 21, 1959. 52p.

The general behavior of currents induced by high energy radiation in polyethylene is described. Certain considerations regarding design of circuits for operation in large radiation fluxes are discussed. The dose-rate dependence of x-ray induced photocurrents found by previous investigators at lower dose-rates appears to be extended to dose-rates as high as 15,000 r/min. The theoretical implications of this extension are discussed briefly. Calculations suggest that electrons freed from polyethylene molecules by ionizing radiation succeed in escaping permanently from their parent molecules. Attempts to measure ultraviolet-induced photocurrents in certain solidified organic solvents at near-liquid-nitrogen temperatures place an upper limit of 2×10^{-15} mho/cm on their photoconductivities at the ultraviolet intensities used. Some question is raised concerning the mechanism of color-center formation in Wurster's Blue under ultraviolet irradiation. A property of polyethylene which may be useful in detecting high-energy radiation in regions of low temperature, such as interplanetary space, is reported. (auth)

19657 WADC-TR-58-264(Pt. II)

Inland Testing Labs., Morton Grove, Ill.

THE BEHAVIOR OF FUELS AND LUBRICANTS IN DYNAMIC TEST EQUIPMENT OPERATING IN THE PRESENCE OF GAMMA RADIATION. M. E. Krasnow, O. P. Reynolds, O. C. Wolford. Mar. 31, 1959. 180p. Project No. 3104. Contract AF-33(616)-3865. OTS.

Fuels, lubricants, and hydraulic fluids for use in a nuclear-powered aircraft were evaluated. The most promising fuels and lubricants are listed in the accompanying tables. These materials were selected on the basis of performance in dynamic test machinery operated in a radiation environment. Performance characteristics of lubricants up to doses of 10^{10} ergs/C and of fuels up to 10^{9} ergs/gC are noted. (auth)

19658

EFFECT OF FISSION RATE AND LAMELLA SPACING UPON THE IRRADIATION-INDUCED PHASE TRANSFORMATION OF U–9 wt. % Mo ALLOY. M. L. Bleiberg (Westinghouse Electric Corp., Pittsburgh). J. Nuclear Materials 1, 182-90(1959) July.

Samples of U–9 wt. % Mo alloy of various U^{235} enrichments and interlamellar spacings were neutron irradiated at low temperatures, and the kinetics of the neutron-induced phase transformation determined by electrical resistivity measurements. The kinetics of this reaction may be described in terms of macroscopic diffusion occurring within a "displacement" or a "thermal spike." The diffusion coefficient was determined to be $1.4 \times 10^{-18} \pm 0.6 \times 10^{-18}$ cm^2/sec for a fission rate of 5.25×10^{12} fissions per cm^3/sec. The diffusion coefficient was found to be directly proportional to the fission rate, but independent of sample temperature between –90°C and +200°C and of neutron flux intensity. (auth)

19659

COMPARISON OF DYNAMIC AND STATIC IRRADIATION TESTS OF AIRCRAFT FLUIDS. R. J. Neely (Convair, Fort Worth, Tex.) Lubrication Eng. 15, 325-7; 340(1959) Aug.

Four examples of dynamic and static irradiation of aircraft fluids are presented. The dynamic samples were irradiated while operating in component aircraft systems. The static samples were placed to receive approximately the same integrated flux dose. Static and dynamic results were divergent. Such standard evaluation tests as viscosity, specific gravity, and index of refraction indicated that breakdown of the fluid was accelerated by operating in a nuclear environment. Predictions of the service life of these particular fluids could not be based on static irradiation. Changes generally occurred most often in the viscosity and neutralization number of the fluids. (auth)

19660
A DOSE TEST FOR IRRADIATED POLYETHYLENE. E. H. Cornish and D. M. Cutting (Standard Telecommunication Labs., Ltd., Enfield, Middlesex, Eng.). Nature 183, 1804-5(1959) June 27.

The deformation of irradiated polyethylene was studied with a Williams plastimeter. Results were incorporated into a test of dose response for irradiated polyethylene. (C.H.)

19661
AN INVESTIGATION OF CENTERS OF CAPTURE OF IRRADIATED QUARTZ CRYSTALS WITH INSERTED Na IONS. E. N. Batrak. Soviet Phys.–Cryst. 3, 102-4(1958) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 16355.

RADIOACTIVE WASTE

19662 SO-45
Geological Survey, Albany, N. Y.
HYDROLOGIC AND TRACER STUDIES IN MOHAWK RIVER AT KNOLLS ATOMIC POWER LABORATORY. E. S. Simpson, W. A. Beetem, F. H. Ruggles, Jr., et al. July 1959. 300p. $5.00(OTS).

The probable effects of release of low concentration radioactive waste from the Knolls Atomic Power Laboratory to Mohawk River were investigated. The area of primary interest was Niskayuna Pool, about 15 miles upstream from the confluence of Mohawk and Hudson Rivers. Data on mean flow, flow duration, frequency of floods and of periods of low flow, based on a record for the period 1926-55 of Mohawk River at Cohoes and other points are presented. A continuous record of river stage was obtained at the Knolls beginning in 1948, and is useful as an adjunct to the Cohoes record. During the period 1951 to 1956, data on the chemical quality, temperature, and radioactivity of surface and ground waters in the area were collected. Investigations of sediment and bed material of Mohawk River in the vicinity of Knolls were performed. Three radiotracer tests were conducted, in 1953 and 1954, using the isotope, phosphorus-32. Methods of tracer introduction and of instrumentation were developed for the particular conditions of the tests. The tests indicated that the initial path and dilution of the isotope were sensitive to difference in density between conveying medium and river water. A study of the data pertaining to passage downstream of the isotope indicates that the rate of take-up varied with time rather than with river discharge. The take-up may be connected with the biologic regimen of the river rather than the hydrologic regimen. (auth)

19663 TID-3535
Technical Information Service Extension, AEC.
RADIOACTIVE DECONTAMINATION. A Literature Search. William E. Bost, comp. Sept. 1959. 36p. $1.00(OTS).

This literature search includes 351 references to unclassified reports on radioactive decontamination. (J.E.D.)

19664
CHARACTERISTICS OF REACTOR FUEL PROCESS WASTES. J. O. Blomeke, E. D. Arnold, and A. T. Gresky. Proc. Am. Soc. Civil Engrs. 85, No. SA2, 1-10(1959) Mar.

The types and characteristics of high-level radioactive liquid wastes produced from reactor fuel processing plants are reviewed. The chemical and physical properties of these wastes are delineated and characterized for each of five specific processing methods currently in use and of three methods under development. The radionuclide distribution and the decay heat properties of such wastes as related to time of decay are also given. (auth)

REACTORS

General

19665 AERE-R-2981
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A NEUTRON BEAM SOURCE BLOCK FOR A TANGENTIAL HOLE IN A WATER-MODERATED REACTOR. R. F. Dyer, G. G. E. Low, and R. D. Lowde. June 1959. 6p. $0.16(BIS).

A source block was designed with which to extract a thermal neutron beam from a tangential hole of the enriched uranium heavy water reactor PLUTO. It consists of a slab-shaped aluminum box of ordinary water, 1.5 cm in thickness, held at a grazing angle of 18° to the emergent beam. The intensity obtained is 25% greater than that given by an ordinary right-circular cylindrical plug of scattering material. (auth)

19666 ANL-5983
Argonne National Lab., Lemont, Ill.
ARGONNE HIGH-FLUX RESEARCH REACTOR–AHFR CONCEPTUAL DESIGN STUDY. L. E. Link, R. H. Armstrong, T. C. Cameron, J. B. Heineman, C. N. Kelber, P. H. Kier, H. F. Reed, R. R. Rohde, A. D. Rossin, and W. R. Ware. June 1959. 76p. Contract W-31-109-eng-38. $2.00(OTS).

This report presents a reactor design to meet the needs of the basic research program at Argonne National Laboratory. The program requires some irradiations in thermal neutron flux approaching 5×10^{15} n/(cm^2)(sec) and some beam experiments having over 10^{15} n/(cm^2)(sec) available. Parametric studies indicate that the highest peak thermal flux per unit of reactor power can be obtained in an internal H_2O reflector having a radius of about 6 cm. Since the design efforts recognized total reactor cost as a major parameter, an all H_2O-cooled system was adopted as most expedient. Further, the design and calculations effort was directed toward operating conditions which require little or no research effort. This latter point is a recognition both of the over-all cost plus a desire to meet the needs of research in the shortest possible time. (auth)

19667 BAW-1067
Babcock and Wilcox Co. Research Center, Alliance, Ohio.
LIQUID METAL FUEL REACTOR EXPERIMENT—CORROSION RESISTANCE OF Mo-0.5% Ti ALLOY, TANTALUM, AND BERYLLIUM IN LIQUID BISMUTH. J. W. Seifert. May 14, 1959. 23p. Contract AT(30-1)-1940. $0.75(OTS).

These tests were conducted to determine the corrosion resistance of molybdenum–0.5% titanium alloy, tantalum, and beryllium to liquid bismuth at simulated LMFRE operating conditions. Sample coupons of

molybdenum–0.5% titanium alloy, tantalum, and beryllium were exposed to the LMFRE fuel solution (bismuth containing uranium, zirconium, and magnesium additives) for 1000 hr in a tilting capsule test. The metals exhibited good corrosion resistance in the bismuth fuel solution. The weight changes observed for these specimens were small in some cases, about the same as the weight loss due to cleaning. The metallurgical examination indicated that no corrosive attack occurred. (auth)

19668 BMI-B-3

Hahn-Meitner-Institut für Kernforschung Berlin.

ERWÄRMUNG DER SPALTSTOFFLÖSUNG IM ABLASS-TANK BEIM BERLINER FORSCHUNGSREAKTOR. (Heating of the Fuel Solution in the Discharge Tank of the Berlin Research Reactor.) H. Gaus. Mar. 1959. 11p.

The discharge tank of the Berlin Research Reactor has no cooling circuits; therefore the uranyl sulfate solution may be heated by the beta and gamma radiation of the fission products (the so-called delayed radiation). This heating was estimated with respect to a possible boiling of the solution or a resulting excess pressure. (J.S.R.)

19669 CF-59-7-31

Oak Ridge National Lab., Tenn.

TEST OF HEATER AND COOLER CONCEPTS FOR GCR-ORR LOOP, DESIGN 4. W. H. Kelley, Jr., and E. Storto. July 13, 1959. 27p. Contract W-7405-eng-26. $4.80(ph), $2.70(mf) OTS.

High heat flux electrical cartridge heaters were tested with direct air cooling under simulated ORR Loop conditions. The cartridges and the heater design were found to be satisfactory. A gas cooler of concentric pipe design utilizing air, water, and air-water mixtures as the coolant was also evaluated and found to be satisfactory. Heat transfer calculations are compared with the experimental data and found to correlate within 10%. (auth)

19670 CF-59-8-72

Oak Ridge National Lab., Tenn.

PHASE STABILITY OF HOMOGENEOUS REACTOR HOT FUEL SOLUTIONS. C. J. Barton, J. S. Gill, G. M. Habert, W. L. Marshall, and R. E. Moore. Aug. 18, 1959. 10p. Contract W-7405-eng-26. $1.80(ph), $1.80(mf) OTS.

Portions of two samples of HRT fuel solutions were sealed in silica capillary tubes approximately three weeks after they were removed from the reactor and the temperature at which each solution separated into two liquid layers was determined. The values found, 325 ± 1°C for one sample and 326 ± ½°C for the other, are slightly lower than predicted from experiments with synthetic fuel solutions (329–330°C) but the discrepancies are small enough so that they could be accounted for by the minor differences in composition between the synthetic and reactor fuel solutions. There appears to be little reason to believe that the high radiation level which the fuel solution is exposed to in the reactor has a significant effect on its phase behavior, at least after it has cooled to 2r per ml. Dilution of fuel solution with 8 vol.% of 30% H_2O_2 and with the same amount of H_2O increased the two-liquid phase formation temperature about 2°C but increasing the free D_2SO_4 concentration from about 0.017 to 0.04 M raised the immiscibility temperature 19 to 345°C. (auth)

19671 CRDC-854

Atomic Energy of Canada Ltd., Chalk River, Ont.

CHEMICAL EXPERIENCE WITH THE RECIRCULATION COOLING SYSTEM OF THE NRX THERMAL SHIELDS. G. M. Allison. Mar. 1959. 18p. (AECL-847). $0.50 (AECL).

The mild steel thermal shields in the NRX reactor were cooled for the first eight years by Ottawa River water with added phosphate, alkali and chlorine, on a once-through basis. In the summer of 1955 the cooling system was changed to recirculation, and this report deals with chemical and corrosion results obtained since that time. Considerable difficulty was experienced in raising the pH of the recirculating water to >9 and keeping it there. This was attributed in part to conversion of the old iron-phosphate corrosion film to an oxide film. The thermal shields have been cooled with recirculating steam condensate at pH 9.0–9.5 for the past three years. Since recirculation began, the rate of increase of iron concentration in the water has dropped from about 6 ppm/day to 1 ppm/day. It was observed that the rate of iron accumulation in the water was affected by reactor operation, being much lower when the reactor was down. The use of ion-exchange resins for purification was restricted to the first few months of recirculation since the columns were far too small to handle the impurities building up in the water. A feed-and-bleed operation involving steam condensate made alkaline with KOH was used for a considerable time to control the iron concentration in the recirculating water. Since November, 1957, no purification has been employed. Mild steel corrosion specimens have indicated a corrosion rate of 50–100 $mg/dm^2/mo$ in the parts of the system with high flow rates. An iron-release rate of 10 $mg/dm^2/mo$ has been calculated from the average iron buildup in the water of 1 ppm/day. Since the feed-and-bleed procedure was stopped the water has remained essentially oxygen-free, and the hydrogen concentration has been ~20 cm^3/kg. (auth)

19672 CREL-853

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

OPERATIONAL AND CIRCUIT ASPECTS OF THE NRU TEMPERATURE CONTROLLER. C. G. Lennox and A. Pearson. July 1959. 28p. (AECL-852). $1.00 (AECL).

Information is presented from which maintenance procedures can be derived. The basic temperature control system is described along with calibration procedure, controller operation, and circuitry. Block diagrams and charts are included. (J.R.D.)

19673 CRR-836

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

CONTAMINATION OF THE NRU REACTOR IN MAY 1958. J. W. Greenwood. May 1959. 52p. (AECL-850). $1.50(AECL).

In May 1958 a piece of irradiated uranium fuel burned in the main room of the NRU Reactor building. The building was severely contaminated, and the reactor was shut down for several months for decontamination and rehabilitation activities. Despite the potential hazards, no harm came to personnel and the reactor suffered only minor damage. Investigations were conducted to determine what lessons could be learned to prevent similar incidents in the future. Events leading up to the incident are briefly stated, and the problems faced in putting the reactor and its building back into operation are described. (D.E.B.)

19674 ESSO-MA-1

Esso Research and Engineering Co. Products Research Div., Linden, N. J.

THE EFFECT OF RADIATION ON PETROLEUM AND ITS PRODUCTS. E. F. Baxter, Jr. and J. F. Black. Aug. 1, 1959. 19p. Contract MA-1814. $0.50(OTS).

The radiation chemistry of pure hydrocarbons was reviewed to illustrate the reactions of the various hydrocarbon types found in petroleum and petroleum products. These studies show that unsaturated compounds are more reactive than saturates, and aromatic compounds are the most stable of all. The radiation resistance of polynuclear aromatic compounds extends to high temperatures, which makes these materials interesting as moderator-coolants for nuclear reactors. Irradiation experiments with multicomponent systems indicate that data on individual organic compounds cannot predict the radiolysis behavior of complex mixtures of the type found in petroleum. A review of the available data on the radiolytic behavior of petroleum fractions reveals that they can usually be exposed to radiation dosages in the range of 10^6 to 10^8 rads without serious damage to properties affecting their end use. With jet fuels, for example, doses in the neighborhood of 10^7 rads have been observed to produce threshold damage effects. Petroleum-based lubricants can generally withstand several times this amount of radiation. Literature data on diesel fuel, gasoline, and other petroleum fractions are meager, but it appears that they should be as stable as jet fuel unless they contain radiation-sensitive additives such as tetraethyl lead. Crude oil apparently is more radiation resistant than any of the products prepared from it. The available data on the evolution of gas from irradiated hydrocarbons show that the range of gas yields is 1 to 5 milliliters of gas/milliliter of liquid per 10^8 rads dosage. A consideration of the possibility that gamma rays and fast neutrons may differ in their effectiveness for causing radiation damage has led to the conclusion that in most cases serious errors will not be introduced by assuming equal damage from equal energy input. (auth)

19675 ESSO-MA-2

Esso Research and Engineering Co. Products Research Div., Linden, N. J.

THE APPLICATION OF PETROLEUM AND PETROLEUM PRODUCTS AS SHIELDING IN NUCLEAR PROPELLED TANKERS. E. F. Baxter, Jr. and J. F. Black. Aug. 1, 1959. 10p. Contract MA-1814. $0.50(OTS).

Use of petroleum cargoes as shielding in nuclear powered tankers is discussed. The outlook for replacement of all or part of the conventional secondary shielding by crude oil or petroleum products appears particularly promising. To date, three designs for nuclear tankers have proposed the use of petroleum as secondary shielding. Radiation dosages to the secondary shields in these designs range from 1.4 to 2500 rads/day, but even in the most severe case, the cargo would absorb in 100 days less than 3% of the radiation dosage causing even minor damage to petroleum products. More advanced and more economical designs for secondary shields using tanker cargo are thus clearly feasible from the radiation stability standpoint. The economic incentive for using cargo as primary shielding in a tanker, however, is uncertain at present. The chance of neutron activation in the cargo appears to be the most serious limitation on this application, while radiation induced corrosion of tankers in water ballast may likewise restrict the substitution of crude oil or finished products for conventional primary shield materials. Based on the design for an OMR powered tanker which proposes Dowtherm in the primary shield, serious radiation damage to a petroleum cargo appears unlikely. (auth)

19676 ESSO-MA-3

Esso Research and Engineering Co. Products Research Div., Linden, N. J.

THE APPLICATION OF PETROLEUM PRODUCTS AS MODERATOR-COOLANTS IN MARINE PROPULSION REACTORS. E. F. Baxter, Jr. and J. F. Black. Aug. 1, 1959. 15p. Contract MA-1814. $0.50(OTS).

Use of petroleum fractions as moderator coolants in place of the terphenyl mixture currently employed in organic moderated reactors should provide substantial savings in coolant replacement cost. A re-examination of the early data on the stability of organic materials indicates that petroleum fractions composed principally of condensed ring aromatic compounds should approach the terphenyls in radiation and thermal stability. The purification system currently employed in the OMRE utilizes batch distillation at reduced pressure to remove the products of radiolytic and thermal degradation from the terphenyl type coolant to prevent fuel element fouling and to minimize coolant pumping requirements. All material boiling above para-terphenyl is discarded as high boiling residue. Both the purification system and the stored residue will decrease the cargo capacity of an OMR tanker, and consequently improvements in purification techniques are desirable. An improved purification technique may also result in lowered coolant replacement cost through reduction in the amount of material discarded as residue. (auth)

19677 FPP/P-2

Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.

PRELIMINARY CONSIDERATIONS FOR PRODUCTION OF ELECTRICITY, USING THE HEAT GENERATED IN A PILE. J. L. Dickson, H. H. Gott, and R. A. Pearse. Sept. 19, 1947. 22p.

Principles for generating electrical power utilizing the heat of a pile are discussed. Primary consideration was given to realizing a satisfactory thermal efficiency, comparable with modern power station practice, together with complete utilization of the heat of the pile. A preliminary survey of the factors influencing the choice of operating conditions is given. The proposed scheme would in particular be applicable to a natural uranium gas cooled pile with a graphite moderator. (W.D.M.)

19678 GA-166

General Atomic Div., General Dynamics Corp., San Diego, Calif.

INTRACELL FLUX DISTRIBUTIONS AND THERMAL DISADVANTAGE FACTORS FOR URANIUM RODS IN HEAVY WATER OBTAINED BY THE S_4. APPROXIMATION. Egil K. Bjørnerud. July 16, 1957. 42p. Project No. 17b. For Aktiebolaget Atomenergi, Stockholm.

Calculations similar to those presented in GA-93 were performed in order to investigate in a more systematic manner the effects of cell dimensions and the nuclear properties of fuel and moderators upon the flux distribution in the cell. The input parameters are given and the final output of the IBM-704 is shown. The total disadvantage factors were plotted as a function of fuel rod radius and fuel absorption cross section. (W.D.M.)

19679 HMI-B-4

Hahn-Meitner-Institut für Kernforschung Berlin.

MESSUNGEN DER MATÜRLICHEN UND KÜNSTLICHEN RATIOAKTIVITÄT IN DER UMGEBUNG DES "BER" IM JAHRE 1958. (Measurements of the Natural and Artificial Radioactivity in the Vicinity of the "BER" in the Year 1958.) W. Jacobi and H. Stephan. Apr. 1959. 40p.

A compilation of the radioactivity measured in the vicinity of the Berlin Research Reactor in 1958 is presented. Data are presented on the activity of the air at ground level, the fission product activity in fall-out, long-lived beta activity in surface water and the city water supply, activity of soil and plant samples, environmental radiation, and the radon content of the air in the reactor building. It was established that the radioactivity at the reactor site shows no abnormal increase. The measured activity of the fission products from atomic explosions agrees with other measurements made in Germany in 1958. (J.S.R.)

19680 HW-59372

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DETAILED PROCEDURE FOR K REACTORS REAR FACE DECONTAMINATION BY CHEMICAL FLUSH OF THE REAR CROSSHEADERS, PIGTAILS AND NOZZLES AS AUTHORIZED BY THE PRODUCTION TEST AUTHORIZATION IP-239-N. W. A. Crossman. Feb. 25, 1959. 13p.

A detailed, chronological procedure for the preliminary decontamination and post-decontamination steps is presented. Required operations are given in sufficient detail to successfully accomplish the intent of the test. (D.E.B.)

19681 HW-61084

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DIVISION OF REACTOR DEVELOPMENT PROGRAMS MONTHLY REPORT, JUNE 1959. July 15, 1959. 38p. Contract AT(45-1)-1350. $7.80(ph), $3.30(mf) OTS.

Basic studies were continued on Pu fuels development, and data are given on one hour hold times across the UO_2-PuO_2 composition limits. Observations made during metallographic examination are discussed, and results of sintering UO_2 are examined. Preliminary examination of a full-length Zircaloy-clad wire-wrapped dummy element after thermal cycling in the Elmo-7 loop at 1530 psig is reported. Further tests using a Mark I-B 19-rod cluster were completed, and the cluster is being examined. Production of Al–Pu billets by the PuO_2–Al–cryolite reduction process is reported. Data on injection casting using various core materials are discussed, and fuels for future PRTR and PCTR loadings are being studied. Preliminary results of Zircaloy-2 clad fuel element magnetic force butt welding were evaluated, and results are encouraging. Sintered and compacted powders produced by a vibration system were found to be entirely acceptable. Effects of swaging on various types of cladding are being evaluated, and a method of testing Zircaloy-2 tubes prior to swaging was developed. In fuel evaluation, a 3 ft long UO_2 rod and tube element which ruptured after reinsertion in ETR was examined. Results indicate that the failure may be due to restriction of the outer cladding coolant annulus by one or more thermocouples. Observations on an irradiated cored and sintered UO_2 fuel element after failure are listed. Test results of two 18 in. long 7-rod UO_2 cluster elements indicate that no ruptures occurred in a KER loop test. Corrosion studies include those for allowable Zr concentrations in HNO_3–HF PRTR fuel element etch bath and a dynamic bath for etching and autoclaving PRTR rod clusters. Rupture testing of simulated Al–Pu fuel elements is reported in a 30-hr, 300°C test. No swelling or deposit buildup was noted. All PRTR Zircaloy jacket tubing was examined by use of a fluorescent penetrant dye. Heat transfer experiments are reported in which the heat flux at which boiling burnout in PRTR is expected are reported. Progress in mechanical equipment development is summarized. Included are data on a 405-hr test of a PRTR primary process pump, results of calandria mock-up tests, seal testing results, and results of Inconel X loop tests. Compilation of data and charts of input reactivity for the various transient cases to be studied on the analog computer were completed. The various cases are described. Hazard studies for various PRTR mechanical failures are summarized. Included are consideration of the effects of 14-in. header failure, maximum pressure of a shroud tube following a process tube rupture, and flow decay and equilibrium conditions following complete loss of a single primary coolant pump. A summary of the PRTR construction phase status is given along with discussion of other design progress related to PRTR and the Pu fabrication plant. Activities in PRTR planning included work on a PRTR technical manual, an operations handbook, and design of a data processing system. Tests indicate that loss of Pu to the $NH_4F-NH_4NO_3$ decladding solution can be reduced by treatment of the Pu core with HNO_3 before it is encased. Reduction of UO_2Cl_2 resulting from exposure of UO_2 and U_3O_8 to molten chloride salt is being studied. Reduction is complete; the UO_2 appears as a crystalline particle in the 30 to 300 mesh range. Other developments include preliminary Hg isotope separation, fabrication of an automatic ball mill feed controller, fluid bed ion exchange studies, and investigation of certain boiling metal characteristics. Simulated swelling experiments by measuring the diffusion of rare gases in uranium are in progress along with experiments to determine U pore size distribution. Results of graphite oxidation experiments using CO_2 are reported. Completion of the 105 Gas-Cooled Loop for use in the Maritime Gas Cooled Reactor Program is announced. Methods of generating and detecting ultrasonic waves in magnetic materials are being investigated. The efficiency of the method is low at present. Experiments aimed at removing strontium from Redox waste with clinoptilolite were successful. Cost information is being obtained. In radiant heat spray calcination experiments, high Al wastes were calcined at 650 to 825°C. The process was smooth; however, the product density was low. (For preceding period see HW-60674.) (J.R.D.)

19682 HW-61575

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DIVISION OF REACTOR DEVELOPMENT PROGRAMS MONTHLY REPORT–JULY 1959. L. H. McEwen, comp. Aug. 17, 1959. 39p. Contract AT(45-1)-1350. $3.30(ph), $2.40(mf) OTS.

Plutonium Recycle: Compacts of mixed UO_2-PuO_2 were sintered at temperatures up to 1600°C for one to eight hours. The density-composition plot shows a maximum in the range 20 to 40% PuO_2. Fuel fabrication studies were continued with various thermal cycling

tests on clad and unclad specimens of Al–Pu alloys. Minor changes were made in the procedures for fabricating UO_2 elements which facilitate the production of a more economic and uniform element. Fluorescent penetrant, ultrasonic, and x-ray techniques for detecting defects in Zircaloy-2 tubing were further developed and used in investigations of defect development during the various fuel element fabrication steps. A new Zircaloy etch bath composition was developed which uses technical grade rather than C. P. acids. Experiments indicate boiling burnout will be experienced in the Mark II fuel element at 1,150,000 Btu/hr-ft^2 with a steam quality of 20% by weight. Additional tests on PRTR mechanical components such as pumps, valves, seals, control rod gears and bearings, and coolant instrumentation are described. The effects of D_2O loss on the reactivity of PRTR were determined. The largest effect, about 10 mk, appears in the fast fission factor. Progress in PRTR design, construction, and hazards analysis is summarized. Chemical Research: Both UO_3 and U_3O_8 were found to chlorinate more readily than ceramic grade UO_2. Chlorination time was considerably reduced by increasing temperature from 800 to 900°C. The reaction of UO_2 with anhydrous N_2O_4 appears to proceed through a $UO_{2.25}$ intermediate to $UO_2(NO_3)_2$ and another oxide phase with a lattice of $A_0 = 5.40$ A. The boiling metal column was operated with Pb–Bi eutectics containing 5, 10, and 20% Hg. Boiling points were 530, 480, and 420°C, respectively. Swelling Studies: Optical and electron microscopy were used in investigations of irradiated U in an effort to extend present knowledge of rare gas fission product mobility and pore formation. Gas Cooled Reactors: Hollow cylinders of graphite were found to oxidize three times as fast as solid cylinders in CO_2 at 700 to 850°C. Microwaves may be used in producing oxygen and ions in CO_2; simulating radiation effects. (For preceding period see HW-61084.) (D.E.B.)

19683 IDO-16395(Add.)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ADDENDUM TO INSTRUMENT AND ELECTRICAL STANDARD PRACTICES FOR MTR AND ETR. L. H. Jones, ed. July 30, 1959. 14p. Contract AT(10-1)-205. $0.50(OTS).

Technical specifications for the Engineering Test Reactor experimenter's data handling system which was installed in May 1959 are presented. Also, the system of ductwork and other facilities installed for the use of the ETR experiments are described. These allow the tie-in of a small number of thermocouples and instrument leads into recorders or to the experimenter's data reduction system with a minimum of special equipment and installation time. (auth)

19684 JAERI-1001

Japan. Atomic Energy Research Inst., Tokyo.

DESIGN CALCULATIONS OF JRR-3 (NATURAL URANIUM HEAVY-WATER RESEARCH REACTOR). PART 1. CORE CALCULATIONS. Hiroshi Ishikawa, Takumi Asaoka, and Yutaka Sasakura. 1959. 72p.

The paper shows the nuclear design calculation for the Japan-made reactor No. 1 (JRR-3), a 10 Mw natural uranium heavy-water research reactor. At the present stage of the nuclear design calculation, an accurate and simple method is not available, so a few lattice parameters must be set from the preliminary calculation and then a more accurate process is continued with these parameters. The well-known classical, four-factor formula for the multiplication constant and the two-group theory are used in this process. However, the four factors and the migration area are calculated by more accurate methods such as the P_3-approximation for the thermal utilization. For the purpose of checking the method, the bucklings for exponential assembly are estimated and compared with the experimental data of the North American Aviation and Sweden. Through these calculations, the core of 1.3m in radius and 2.75m in height is determined. 245 fuel rods of 2.5 cm in diameter are arranged on a regular triangular lattice of 15 cm pitch. Six ton natural uranium and 15 ton heavy-water are necessary for the core. At the designed power of 10 Mw, maximum thermal neutron flux is expected to reach 2×10^{13} n/cm^2 sec. (auth)

19685 KAPL-M-EJ-9

Knolls Atomic Power Lab., Schenectady, N. Y.

HYDRAULIC INSTABILITY OF REACTOR PARALLEL-PLATE FUEL ASSEMBLIES. E. B. Johansson. July 13, 1959. 43p. Contract W-31-109-Eng-52. $7.80(ph), $3.30(mf) OTS.

The work on the hydraulic collapse or instability of flat plates was extended by considering flow redistribution and the effect of unequal friction drops in the deflected region of the channels. A general formula for the pressure distribution over a plate as a function of the plate deflection is derived. From this general formula, linearized formulas for small deflections are derived for the pressure distribution and the critical velocity. Graphs of pressure distribution for various assumed deflection curves are presented. Formulas and curves are given for the magnification of initial deflections as a function of approach to the critical velocity. (auth)

19686 KAPL-M-GDH-1

Knolls Atomic Power Lab., Schenectady, N. Y.

INVESTIGATION OF TEMPERATURE COEFFICIENTS OBTAINED FROM PRESSURE TEST REACTOR. G. D. Hickman and J. A. Bistline. July 23, 1959. 39p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

Starting from the criticality equation for a bare fission reactor an equation expressing the change in reactivity with respect to temperature (temperature coefficient) is obtained. This expression includes the change of age, diffusion length, and cross sections with temperature. The temperature coefficient is written as a function of moderator temperature, neutron temperature, fuel density, moderator density, and the first derivative of the moderator density with respect to temperature. There are two unknown quantities in the expression, i.e., $2\tau B^2$ and B^2L^2, which are removed by determinations of the temperature coefficient at temperature T_1 and T_2. Therefore, having removed these quantities, the temperature coefficient at any other temperature is calculable. This analysis has been performed using temperature coefficients obtained from 10 different cores and reflectors which were examined in the PTR Critical Assembly at KAPL. The results of these analyses are that two experimental determinations of the temperature coefficient are sufficient (for the cores examined) to determine the temperature coefficient at any other temperature, in the range 200–500°F, with a high degree of accuracy. (auth)

19687 KAPL-M-TFR-11

Knolls Atomic Power Lab., Schenectady, N. Y.

HAFNIUM SLAB ROD EXPERIMENTS IN THE PMA.

T. F. Ruane. July 7, 1959. 16p. Contract [W-31-109-Eng-52]. $3.30(ph), $2.40(mf) OTS.

A series of measurements was made in the PMA-6 uniform slab core in order to evaluate various effects on control rod effectiveness. Effects of rod geometry and size and moderator position in relation to the rods were measured. The samples used in the experiments were Hf slabs 8 × 2.8 inches and of varying thicknesses. (W.D.M.)

19688 MND-E-2006

Martin Co. Nuclear Div., Baltimore.

ERDL–NPFO—QUARTERLY PROGRESS REPORT NO. 8 FOR APRIL THROUGH JUNE 1959. C. Eicheldinger. 59p. Contract DA-44-009-ENG-3318.

An autoclave testing program on stressed and welded Inconel specimens was initiated during this report period. The corrosion loop was in operation approximately 81% of the time during this quarter. The bimetal model heat exchangers, MOD SG-2 and SH-2, were removed from the loop after 5041 hr of testing. Examination of the units revealed extensive general corrosion of the carbon steel secondary sides. Testing was initiated on the Croloy 16-1 models, MOD SG-5 and SH-5, and on the Inconel models, MOD SG-6 and SH-6. The bimetal miniature heat exchanger, MIN-7, was removed from the loop after 3256 hr of testing. Examination revealed general corrosion of the secondary side. MIN-7 was replaced by MIN-5 (430-M). This vessel along with MIN-4 (430-M) and MIN-8 and -9 (Inconel) remain under test. The uniform test section was received from the fabricator. After a number of out-of-loop tests the units and instrumentation were installed in the loop. Additional experiments were performed on the full-core mockup of the SM-1 reactor. No half-width fuel plates were used in this series of experiments. The measured value of critical water height for this core was 9.99 ± 0.05 in. Total core reactivity was measured by several methods. The incremental rod bank withdrawal method yielded a value of 7.9% ΔK/K. Flux spectrum measurements indicate that a spectral shift occurs when the core reactivity is poisoned out with cadmium. The calculated value of total core reactivity was 11.7% ΔK/K. The major reactor calculations and codes required to perform them are being selected. Selected codes such as CANDLE, TURBO, WANDA, S-3, I-2, SIMPL and MARTIN 1D-SN are being checked out. A series of experiments on a clean critical assembly have been completed. The critical mass was 15.7 kg of U-235. Temperature coefficient and fuel and boron worth determinations were made on this core. (For preceding period see MND-E-2005.) (auth)

19689 NAA-SR-Memo-3569

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

STATUS REVIEW OF THE KEWB PROGRAM. J. W. Flora. Jan. 28, 1959. 23p. $4.80(ph), $2.70(mf) OTS.

A review is presented of the KEWB program; the objectives, the accomplishments, and a summary of the work outstanding. The objectives of the experimental and analytical studies were to investigate and reach an understanding of the kinetic behavior of aqueous homogeneous reactors. Information produced by the program, experiments on the spherical core, capsule experiments, and the remaining work schedule are discussed. (W.D.M.)

19690 NDA-84-24(Vol. II)

Nuclear Development Corp. of America, White Plains, N. Y.

SEMI-EMPIRICAL METHODS FOR THE CALCULATION OF D_2O LATTICES AND COMPARISON WITH EXPERIMENT. L. Goldstein and D. Cokinos. July 24, 1959. 31p. Project II. Contract AT(30-1)-2303. $6.30(ph), $3.30(mf) OTS.

Semi-empirical methods for calculating D_2O lattices are described and compared. Included are the French, Swedish, Canadian, and Savannah River methods. These methods require different degrees of experimental support for their development; the resonance escape probability, p, is the most empirical parameter in every case. Results of calculations using French, Swedish, and Canadian methods on experimental lattices indicate good agreement with the most precise data. Extrapolation of these methods, as well as the other methods, beyond the experimental range is of questionable value. (auth)

19691 NP-7762

Iowa State Coll., Ames.

OPERATING CHARACTERISTICS OF A URANIUM GRAPHITE SUBCRITICAL ASSEMBLY WITH COOLANT SIMULATION (thesis). John Henry Hoganson. 1957. 88p.

Experimental and theoretical investigations with uranium–graphite subcritical assemblies were carried out to determine the various nuclear constants of a lattice. The lattice constants were the material buckling, multiplication constant, lattice diffusion length, and thermal utilization of the unit cell including the process tube assembly. In this investigation six lattice configurations were considered. (W.D.M.)

19692 NRL-Memo-936

Naval Research Lab., Washington, D. C.

PROGRESS REPORT ON FAST BREEDER REACTOR SAFETY STUDIES. L. A. Beach, A. G. Pieper, and M. P. Young. May 1959. 35p. Contract AT(11-1)-607. $6.30(ph), $3.00(mf) OTS.

The construction and assembly are nearly completed of a Radiation Scanning Device to observe meltdown of fast breeder reactor fuel elements in the TREAT reactor by means of self gamma emission. The scanning device is now being tested for transmission and space resolution with gamma rays from a collimated beam port in the NRL reactor. This testing has indicated that additional collimation and shielding must be added to the front and back slits to improve the signal to background ratio to a reasonable value. The detectors were assembled and checked out. A new display scheme was devised that will only divide up the image of the test section into two parts instead of the previous eight so that the reassembly into a single picture is greatly facilitated. Suitable trigger and sweep circuits for this new display have been designed and constructed in prototype form. The recording system is being dynamically tested and adjusted independent of the transmission measurements of the drum. Simple tests of the detectors and recording systems were devised for checking operation of the system in the field. (auth)

19693 RDB(W)/TN-44

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

FLATTENING CALCULATIONS FOR THE WINDSCALE PILES. E. Smart. Jan. 7, 1953. 30p.

Methods and numerical constants used in flattening calculations for the Windscale Piles are presented. Their use is illustrated by examples of operational calculations. The accuracy of the calculations was found to deteriorate as the running time of the piles increased, due to uncertainties in the long-term change of k of the piles and in the relative heat transfer efficiencies of the

types of cans. Further work on these points would restore the good initial accuracy. (auth)

19694 RDB(W)/TN-210

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE TEMPERATURE COEFFICIENTS OF BEPO AND THE WINDSCALE PILES. R. R. Gallie and E. Smart. June 1955. 17p. (TRSWP/R-12).

More precise results were obtained from temperature coefficient measurements on Bepo by improved instrumentation and a change in the method of result analysis. The lattice uranium coefficient was found to be $-1.59 \pm 0.1 \times 10^{-5}$ per °C. Early runs consistently gave the lattice graphite coefficient (vacuo) as -3.9×10^{-5}/°C, while later runs gave -3.4×10^{-5}/°C. This discrepancy was taken into account in assessing the error on the graphite measurements, which is considered to be $\pm 0.2 \times 10^{-5}$. These values were compared with the results obtained on the Windscale piles using formulas derived from the lattice calculations. The uranium coefficients and the higher value for the graphite coefficient of Bepo give as good agreement as expected. These results were applied to Pippa. An upper limit of 1.7 per cent k taken up by temperature effects was given. (auth)

19695 TID-3088

Technical Information Service Extension, AEC.

BOILING WATER REACTORS. An Annotated Bibliography of Selected Literature. James M. Jacobs, comp. June 1959. 51p. $1.50(OTS).

A total of 253 references to the unclassified report and published literature, covering all phases of the development of heterogeneous and homogeneous boiling water reactors, is presented. Report number and availability, author, and subject indexes are included. (auth)

19696 CEA-tr-A-321

FABRICATION DES ÉLÉMENTS COMBUSTIBLES TUBULAIRES RÉSISTANT AUX FORTES PRESSIONS À GAINE DE PROTECTION INTÉRIEURE. (Fabrication of Tubular Fuel Elements Resistant to Pressure with Interior Protective Sheath.) E. P. Bodmer, P. De Haller, and P. Sulzer. Translated into French from Atomwirtschaft 3, 491-5(1958). 21p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 8250.

19697

SAFETY AND SITE SELECTION. Robert G. Cochran. J. Eng. Educ. 49, 422-5(1959) Feb.

The problem of site selection and containment must be resolved on the basis of the type of reactor system planned and population density. More specifically the problem reduces itself to assuming the maximum creditable accident acceptable to the AEC. This, of course, involves knowledge of geography, meteorology, climatology, hydrology, geology, etc. Waste disposal also must be provided for and depends upon reactor type, power level, nature of research program, and supporting facilities. More elaborate systems would be required for homogeneous reactors than heterogeneous solid fuel reactors. The various types of facilities for storage and handling of waste are described. The organization and administration for safety of the University of Pennsylvania and University of Michigan reactors is described. In conclusion the author states ..that reactors are inherently safe when properly handled and suitably located on a university campus. (auth)

19698

STAINLESS STEEL CLAD DISPERSION OF BORON IN IRON FOR PRESSURIZED WATER REACTORS. C. F. Leitten, Jr., R. J. Beaver, and A. E. Richt (Oak Ridge National Lab., Tenn.). J. Nuclear Materials 1, 136-44 (1959) July.

The Army Package Power Reactor (APPR-1) is currently operating with a control rod which contains a boron-bearing neutron absorber section. This component is a welded rectangular parallelepiped, in which the sides consist of rolled austenitic stainless steel-clad plates incorporating 3 wt. % boron in iron. This paper presents details describing the design of the absorber section, selection of materials, fabrication procedures, and results of performance under irradiation. The boron, 90% enriched in the B^{10} isotope, is added to iron powder in elemental form and shaped into a rectangular core which is sintered to a high density. Roll-cladding with austenitic stainless steel results in a composite plate in which the cladding is bonded to the boron-iron dispersion. Irradiation testing of small specimens of this product in the MTR indicates no significant damage after 4% burn-up of the B^{10} atoms. Slight swelling appears after 10% burn-up and after 30% burn-up the irradiation damage is serious. Although some damage is expected under APPR-1 operating conditions, the control rods have operated smoothly in this reactor through 9 Mwy of the expected 15 Mwy lifetime. (auth)

19699

RELATIVE CONTROL ROD WORTHS OF SOME RARE EARTH OXIDES. Hugh F. Johnston and John L. Russell, Jr. (General Electric Co., Pleasanton, Calif.) and Walter L. Silvernail (American Potash and Chemical Co., West Chicago, Ill.). Nuclear Sci. and Eng. 6, 93-6(1959) Aug.

In order to determine the relative merits of the various rare earths as reactor control materials, a series of relative worth measurements was made. Combinations of the oxides of five rare earths with highest thermal cross sections (dysprosium, erbium, europium, gadolinium, and samarium) were compared with cadmium and 2 per cent boron steel. Dy_2O_3, Gd_2O_3, and Sm_2O_3, separately and in combination, were found to be roughly equivalent in worth. Eu_2O_3 was found to be the strongest absorber. Er_2O_3 was found to be much less effective than the other materials studied. (auth)

19700

DISTRIBUTION AND ELUTION OF FISSION PRODUCTS UPON ThO_2-UO_3 SLURRY AT SIMULATED REACTOR CONDITIONS. A. R. Fritsch and B. Levy (Westinghouse Electric Corp., East Pittsburgh, Penna.). Nuclear Sci. and Eng. 6, 97-9(1959) Aug.

The adsorption of simulated fission products on slurries of ThO_2-UO_3 mixtures has been studied. Experiments were performed using tracer techniques employing slurries which had been previously pumped in order that the condition of the slurry as well as concentration of the fission products, temperature, and pressure might simulate reactor conditions. Results of some preliminary experiments designed to remove fission products by the use of eluting agents are also reported. (auth)

19701

EPITHERMAL HAFNIUM PARAMETERS FOR THE

CALCULATION OF CONTROL ROD WORTH IN THERMAL REACTORS. T. F. Ruane and M. L. Storm (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 6, 119-27(1959) Aug.

The average epithermal nonabsorption probability ($\overline{P}_2$) for hafnium slabs is calculated by two different methods. Within the framework of a specific two-dimensional, three-energy-group calculational scheme, an empirical value of $\overline{P}_2$ is determined which gives agreement with experimental rod worths. Based on available microscopic cross-section data for the hafnium isotopes, the value of $\overline{P}_2$ is calculated and compared with the empirical value obtained above. The values of $\overline{P}_2$ obtained by these different methods for 0.1 in. and 0.2 in. thick slabs agree to within 10 per cent, thus verifying the physical reasonableness of the empirical probabilities. (auth)

19702

NEUTRON THERMALIZATION CALCULATIONS FOR A HETEROGENEOUS LATTICE CONTAINING URANIUM AND PLUTONIUM FUEL IN WATER. P. Greebler, W. Harker, and J. Harriman (General Electric Co., San Jose, Calif.). Nuclear Sci. and Eng. 6, 128-34 (1959) Aug.

In a low-enrichment reactor at sufficiently high temperature that the Pu^{239} absorption cross section departs appreciably from 1/v, plutonium build-up increases the sensitivity of the calculated thermal cross sections to the thermalization techniques used. Thermal neutron spectra are compared for two thermalization models in a heterogeneous lattice of a low-enrichment water-moderated reactor. Using blackness theory, equivalent homogeneous, monoenergetic cross sections for the lattice are computed at closely spaced energy intervals over the thermal energy range. The energy distribution of the thermal neutron flux is then obtained using both the Wigner-Wilkins and the Wilkins thermalization equations. Calculations are made with the fuel elements assumed to contain only U^{235} and U^{238} yielding almost pure 1/v absorption, and also for the case of appreciable Pu^{239} present in addition to the uranium resulting in a significant departure from 1/v absorption. Sensitivity of the calculated spectrum to the effective mass of the hydrogen is tested by allowing wide variations of the $\xi\sigma_s$ values for water at low energies in several applications of the Wilkins equation. Variations in the thermal neutron spectra, resulting from the choice of the thermalization equation (Wigner-Wilkins or Wilkins), from changing $\xi\sigma_s$, or as a result of plutonium build-up, are evaluated in terms of isotopic cross sections averaged over the spectrum in each case. (auth)

19703

VARIATIONAL CALCULATION OF CONTROL ROD REACTIVITY. Elias P. Gyftopoulos and Luis de Sobrino (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 6, 135-9(1959) Aug.

The reactivity worth of cylindrical control rods of small cross section inserted in a cylindrical reactor is evaluated by means of a variational method. Both one-group and two-group diffusion theory are used and simple formulas are developed for a single eccentric and a concentric array of control rods. The results obtained are illustrated by means of a numerical example and compared to the results derived from other methods available in the literature. (auth)

19704

A DUAL-CHANNEL REACTOR PROTECTION SYSTEM FOR NUCLEAR POWER PLANTS. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-24. Allen S. Bartu (General Electric Co., San Jose, Calif.). New York, Engineers Joint Council, 1959. 21p. $0.50.

A dual-channel, reactor-protection system similar to the one that was developed for the Dresden Nuclear Power Station is described. This protection system utilizes commercially-available components in coincidence circuits to achieve the system reliability that is required for power plant service. (auth)

19705

COLD TRAPS, FREEZE JACKETS AND REFRIGERATION SYSTEM USED IN THE HRE-2. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-30. Roy C. Robertson (Oak Ridge National Lab., Tenn.). New York, Engineers Joint Council, 1959. 29p. $0.50.

A low-temperature refrigeration system is used in the Homogeneous Reactor Experiment (HRE-2) to chill cold traps in the off-gas streams and to chill freezers on the process lines to assure possitive cutoff of flow. The high radiation level in the reactor cell presented special design problems, including selection of a secondary refrigerant. Design and development of the line freezer units had several interesting aspects. (auth)

19706

INVESTIGATION OF CHEMICAL METHODS FOR NUCLEAR REACTOR DECONTAMINATION. Presented at Nuclear Engineering and Science Conference, April 6-9, 1959, Public Auditorium, Cleveland, Ohio. Preprint V-53. John L. Zegger and G. P. Pancer (Alco Products, Inc., Schenectady, N. Y.). New York, Engineers Joint Council, 1959. 15p. $0.50.

The use of an alkaline permanganate-citrate treatment affords an excellent means for decontaminating Type 304 stainless steel surfaces. Decontamination factors greater than 20 were obtained with corrosion rates less than 0.01 mil penetration. Flow rate and temperature were found to be important parameters for successful decontamination. (auth)

19707

STUDIES OF THE MARKET FOR NUCLEAR EQUIPMENT. FUEL ELEMENTS REACTOR COMPONENTS FUEL ELEMENT HANDLING EQUIPMENT. Paris, Organisation for European Economic Co-Operation, 1959. 98p.

The aim is to work out estimates for production of nuclear equipment up to 1965 and even 1970 when possible. The equipment is divided under the three headings of fuel elements, reactor components, and handling equipment for fuel elements. Quantitative appraisals show that, generally speaking, capacity cannot raise any difficulty and that Europe can amply provide for the tonnage of steel, special metals, etc., which the national power programs will involve, as the amounts represent only a very small percentage of total production. (C.J.G.)

19708

REACTOR TECHNIQUES. D. J. Hughes. p.390-446 of "Handbuch der Physik. Band XLIV. Instrumentelle

Hilfsmitel der Kernphysik I." (Encyclopedia of Physics. Volume XLIV. Nuclear Instrumentation I.). S. Flügge, ed. Berlin, Springer-Verlag, 1959. 480p.

The neutron intensities available with reactors are so much larger than those produced by "natural" sources, such as Ra–α–Be, that many new techniques are thereby made possible. These techniques are distinctly different from those used before the advent of reactors. As their details are not well known outside the large laboratories where high flux reactors are located, a description of these techniques is of importance. In order to present the techniques for reactor neutrons, some simple properties are first described. (W.D.M.)

Power

19709 ACNP-5912

Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee.

PATHFINDER ATOMIC POWER PLANT RADIATION SHIELDING STUDY. R. Corcoran, H. C. Crumpacker, and D. M. Leppke. June 22, 1959. 44p. For Northern States Power Co. and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. $7.80(ph), $3.30 (mf) OTS.

Alternate concepts studied for the various shielding requirements in the Pathfinder Atomic Power Plant are described. It is concluded that a concrete shield surrounding the reactor pressure vessel is an adequate biological shield. This shield is made up of two parts; an outer two foot section which is both shield and structural support for the various floors in the reactor building and the inner shield which is strictly a radiation shield. Air cooling of this shield is feasible. Containment vessel space requirements are minimized by an off-center arrangement for the reactor and utilizing earth shielding on the outside of the containment shell. A 26-ft diameter self-supporting carbon steel tank with protective coating appears to be the most economical concept for the shield pool above the reactor. This tank is surrounded by a two foot thick concrete wall for radiation protection. The shielding concept in the turbine building is developed around the basic feature of using the turbine-generator foundation for shielding. Also, by lowering the centerline of the turbine and using a side steam cross-over line, the concrete operating floor is an effective shield without appreciably increasing building cost. The existing water boxes on the condenser and feed-water heaters are used as effective shields to minimize the requirement for additional concrete. The shielding concept in the fuel handling building is developed around the basic feature of using the walls of the used fuel storage pool as common shields for other equipment. The availability and cost of aggregate for high density concrete in the Sioux Falls area is discussed. Except under special and unusual circumstances, its use is not justifiable because of the transportation cost of shipping the aggregate to the site. (auth)

19710 AECU-4257

Duquesne Light Co., Shippingport, Penna.

CONTROL ROD POSITIONS FOR CRITICALITY. SECTION I. EFPH 2797.7. SEVENTH PERFORMANCE. Test Results DL-S-149 (T-550130). First issue, June 3, 1959. 28p. $4.80(ph), $2.70(mf) OTS.

Critical bank heights and bank worths for six different control rod configurations at ambient temperature were determined. (auth)

19711 AECU-4261

Duquesne Light Co., Shippingport, Penna.

DETERMINATION OF COEFFICIENTS OF REACTIVITY. SECTION I. 1692.8 EFPH. FIFTH PERFORMANCE. Test Results DL-S-151 (T-550132). First issue, June 18, 1959. 42p. $7.80(ph), $3.30(mf) OTS.

The temperature and pressure coefficients of reactivity at zero power were determined and tabulated. (auth)

19712 AECU-4262

Duquesne Light Co., Shippingport, Penna.

SAFETY RADIATION LEVEL SURVEY. SECTION II. SECOND PERFORMANCE. Test Results DL-S-157. First issue, June 18, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

The level of the radiation in the non-nuclear portions of the plant during the first significant power run and following significant power runs was determined. The radiation level throughout the area surveyed was found to be only background. (auth)

19713 AECU-4263

Duquesne Light Co., Shippingport, Penna.

CORE INSTRUMENTATION CALIBRATION. SECTION V. FIFTH PERFORMANCE. Test Results in DL-S-162. First issue, June 18, 1959. 14p. $3.30(ph), $2.40(mf) OTS.

The calibration of the thermocouples used to measure the blanket exit and inlet and seed exit water temperatures at constant blanket and seed flows is presented. (auth)

19714 AECU-4265

Duquesne Light Co., Shippingport, Penna.

REACTIVITY LIFETIME (1000 HOUR RUN). SECTION III. FIRST PERFORMANCE. Test Results DL-S-225 (T-612118A). First issue, June 19, 1959. 119p. $18.30(ph), $6.00(mf) OTS.

An investigation was conducted to determine how uniform the power level in the PWR core can be maintained and to estimate the effects of oscillations. The plant was operated for 246 EFPH with no safety shutdowns or insertions. Total operating time was 1004 EFPH. About 177 rod movements were required to maintain power oscillations within the prescribed limits. Except for the great number of rod movements required, the PWR plant operated normally and satisfactorily during the test. Test equipment and procedures are described. Results are presented graphically and tabularly. (J.R.D.)

19715 AECU-4267

Duquesne Light Co., Shippingport, Penna.

PRIMARY SYSTEM RELIEF VALVE TEST. SECTION I. Test Results DL-S-204. First issue, June 23, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

The determination of the leakage rate of the primary system relief valves after repairs and the relation of this leakage rate to temperature of the downstream piping are reported. (auth)

19716 AECU-4292

Duquesne Light Co., Shippingport, Penna.

MONTHLY OPERATING REPORT [FOR] APRIL 1959. 31p. Contract AT(11-1)-292. $6.30(ph), $3.00(mf) OTS.

Operation, testing, personnel training, waste disposal, and water chemistry are summarized for April 1959. (For preceding period see AECU-4168.) (W.D.M.)

19717 AECU-4301

Duquesne Light Co., Shippingport, Penna.

PRESSURIZER SURGE LINE TEMPERATURE GRADI-

ENT. SECTION III. FIRST PERFORMANCE. Test Results DL-S-221 (T-641119). First Issue, July 17, 1959. 21p. $3.30(ph), $2.40(mf) OTS.

This test was conducted to determine the temperature gradient in the pressurizer surge line during a normal plant cooldown. The temperature gradient of the pressurizer surge line for a plant cooldown is, within the limits of accuracy of the thermocouples used, extremely small and for practical purposes is nonexistent between the points at which the data was taken. This is true probably because of the continual circulation, however small, of water through the surge and spray lines of the pressurizer. (auth)

19718 AECU-4312

Vitro Engineering Co., New York.

STATUS OF PRESSURIZED WATER REACTOR REACTIVITY ACCIDENT ANALYSIS. L. Geller, J. Cagnetta, and R. Dobbs. Mar. 5, 1958. 19p. For Westinghouse Electric Corp. Atomic Power Div. Subcontract 73-(14-1025). $3.30(ph), $2.40(mf) OTS.

The construction of pressurized water reactors with large excess reactivities has made possible accidents with fast power excursions. A knowledge of the fastest power transient that a pressurized water reactor is capable of withstanding without destructive effects is an important factor in its safety aspects. Possible methods of attack are defined for three categories of problems: (1) what constitutes a destructive effect in a pressurized water reactor? (2) by what mechanisms is the heat which is generated within a fuel plate during a transient transferred to the coolant? (3) what mechanisms are available for spontaneous reactivity reduction during a transient? (W.D.M.)

19719 APAE-50

Alco Products, Inc., Schenectady, N. Y.

SM-1 RESEARCH AND DEVELOPMENT PROGRAM; FINAL REPORT ON FISSION PRODUCT ACTIVITY IN THE SM-1 PRIMARY COOLANT. Task XIII. Robert A. Hasse. June 30, 1959. 34p. $6.30(ph), $3.00(mf) OTS.

Fission product measurements were made on the SM-1 primary coolant. The airborne activity observed during sampling of the primary system was identified. An analysis was made on the primary coolant for alpha activity and on the secondary water for fission product iodine. (auth)

19720 CENC-1030

Combustion Engineering, Inc. Nuclear Components Dept., Chattanooga.

PHOTOELASTIC ANALYSIS OF THE PWR REACTOR HEAD AT BROWN UNIVERSITY. C. W. Lawton. May 1958. 42p. CE Contract No. 7954-7.

An account is presented of the photoelastic investigations conducted as a part of the effort to design a removable head for the PWR reactor vessel. An attempt was made to find a suitable material for photoelastic castings of large size by mixing and curing various formulations of epoxy resin and hardeners. None of the materials which were tried proved to be superior to the formulation of epoxy resin and phthalic anhydride. Small cap sections were made of a small section of the reactor head which proved to be a feasible method of investigating critical regions in a hemispherical head. The dome models made from Armstrong Resin C-4 and Activator J developed an excessive rind effect of edge stress and proved to be unsuitable for photoelastic analysis. The dome model #3 made of Bakelite ERL 2774 and phthalic anhydride fractured during the heating cycle prior to pressure testing. The conclusion of the investigation was that the design of the PWR Head was satisfactory. (auth)

19721 CF-59-8-41

Oak Ridge National Lab., Tenn.

TWO-LIQUID-PHASE TEMPERATURE LIMITS FOR THE HOMOGENEOUS REACTOR FUEL SOLUTION AND ITS CONCENTRATES: COMMENTS ON SOLID-LIQUID EQUILIBRIA. W. L. Marshall, J. S. Gill, and R. E. Moore. Aug. 11, 1959. 11p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Temperatures are given at which two liquid phases form in a synthetic homogeneous reactor fuel solution and its concentrates. The data show a two-liquid-phase boundary temperature of 332°C for the particular HRT fuel composition and a flat minimum temperature of 305°C for the initial solution concentrated between 6 and 16 times. Experiments on solid-liquid equilibria between 300 and 329°C are presented to indicate solution stability in this temperature region. Some related comments on current HRT operation are given. (auth)

19722 CVNA-27

Carolinas Virginia Nuclear Power Associates, Inc., Charlotte, N. C.

PRELIMINARY HAZARDS SUMMARY REPORT. VOLUME III. PART B. LICENSE APPLICATION. July 15, 1959. 50p. $9.30(ph), $3.60(mf) OTS.

The conceptual design of the Parr Shoals Power Reactor will be, to a large degree, the result of an extensive research and development program now in progress. As a result the accidents and hazards studied should be considered as preliminary and subject to change. The principal inherent characteristics discussed which contribute to the safety of the proposed plant are nuclear stability, fuel element integrity, primary coolant system integrity, and containment. (W.D.M.)

19723 NAA-SR-2780

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE DEVELOPMENTAL ORGANIC REACTOR. J. Jacobson. Sept. 1, 1958. 88p. Contract AT(11-1)-GEN-8. $13.80(ph), $4.80(mf) OTS.

The DOR was designed for a comprehensive developmental program to enlarge the knowledge of organic coolant chemistry, to determine means of decreasing the coolant decomposition rate, to achieve a better understanding of the reactor physics, to perform heat transfer studies, and to test fuel element designs in large size units in a high temperature environment. The DOR will thus extend the possibilities for organic reactor developments beyond the bounds of the present OMRE. The proposed 20 Mw DOR consists of flat, plate-type elements immersed in an organic medium, which serves as both moderator and coolant. Facilities are provided in the reactor core to permit insertion of thimbles wherein various experiments relating to coolant technology can be performed. The reactor will be instrumented to permit testing of large size power reactor fuel elements. Many of the construction details of the reactor, heat removal, and auxiliary systems are identical to those developed for the Organic Moderated Reactor to be constructed at Piqua, Ohio. The proposed location is in the SRE triangle section of Atomics International's Nuclear Development Field Laboratory in the Santa Susana Mountains of California. (auth)

19724 NAA-SR-3635
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRELIMINARY DESIGN DESCRIPTION FOR THE PIQUA ORGANIC MODERATED REACTOR PLANT PIQUA, OHIO (REVISED). [1959?]. 71p. Contract AT-11-1-GEN-8. $13.80(ph), $4.80(mf) OTS.

The Piqua OMR is a 45.5 Mw(th) reactor plant with associated steam generating equipment. Approximately 11.4 Mw of electricity will be generated from the steam supplied to the Piqua Municipal Power Station. The coolant used is Santowax R, a commercially available mixture of terphenyls. Major systems in the reactor plant, in addition to the main coolant loop, include the degasification and pressurization system, the coolant purification system, the pressure relief system, and the decay heat removal system. Preliminary design features are given. (W.D.M.)

19725 NAA-SR-3792
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SMALL-SIZED ORGANIC MODERATED REACTORS (10–40 MWE). Apr. 27, 1959. 44p. Contract AT-11-1-GEN-8. $7.80(ph), $3.30(mf) OTS.

The demonstration of reasonably economic nuclear power from an organic-moderated reactor in the size range of from 10 to 40 Mw(e) holds considerable promise. The technology and economics of the organic moderated reactor in this size range utilizing present day technology are summarized. Preliminary characteristics and economic data are presented for 10, 20, and 40 Mw(e) plants. (W.D.M.)

19726 NAA-SR-3859
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MARITIME ORGANIC MODERATED AND COOLED REACTOR. May 27, 1959. 214p. Contract AT-11-1-GEN-8. $3.50(OTS).

The results of a conceptual design study of an organic moderated and cooled reactor (OMCR) power plant adapted to a Class T-7 tanker are described. The conceptual design study encompassed the ship's power plant including the reactor, primary loops, reactor auxiliary equipment, turbine system, and standby power equipment. The ship's reactor machinery space and weight requirements were considered, and plant operating characteristics, hazards, capital costs, and operating costs were estimated. The study was directed at achieving an advanced organic moderated and cooled reactor conceptual design which would yield the lowest ship operating costs based upon currently available reactor technology and upon a construction schedule of 48 months. The most recent design information which was developed on similar organic moderated reactor projects, together with information contained in a previous maritime OMCR design, was utilized in the study and incorporated into the conceptual design. The 48 month construction schedule permits a reactor development program which could extend over a two-year period prior to the actual construction of the reactor equipment. An outline of the recommended development program and its estimated cost is also included. (auth)

19727 NAA-SR-Memo-920
North American Aviation, Inc., [Downey, Calif.]
BALL TYPE SAFETY ROD HEAT TRANSFER STUDY. H. L. Sletten. Mar. 10, 1954. Decl. Nov. 6, 1958. 20p. $3.30(ph), $2.40(mf) OTS.

From the standpoint of the effects of temperature in boron-steel balls on the successful operation of the Ball Type Safety Device, there appeared to be three conditions which may be critical: (1) heat generation and temperature reached by the first falling ball, (2) temperature of the balls in their static position in the hopper above the reflector, and (3) the temperature of balls that may remain at the bottom of the thimble after recovery. These three situations are studied for the Sodium Reactor Experiment, P-16, in which $\frac{1}{8}$ inch diameter 2 per cent by weight boron in steel is considered. It is found that the temperature of a first ball will increase not more than 8°F as it passes through nitrogen in the core at rated power. The temperature of the balls in the hopper will be about 120°F above the temperature of a 1000°F hopper wall. A ball at the bottom of the thimble which is bathed by 500°F sodium at the core-reflector interface will have a temperature less than 1010°F. Appendix I includes an extended heat transfer analysis of a ball falling through a reactor core for a situation in which the heat capacity of the ball is small and assumed to be negligible in comparison to the heat which is liberated from the ball by convection and radiation. It is not applicable to P-16 unless one or more of the specific conditions of neutron flux, ball transient time in the core, length of reactor, and boron concentration are increased so that the total effect is to increase the integrated heat generation by a factor of 10 or more. (auth)

19728 NAA-SR-Memo-969
North American Aviation, Inc., [Downey, Calif.].
BALL SAFETY DEVICE, PHASE I—RECOVERY OF BALLS. E. Phillips. May 4, 1954. Decl. Nov. 6, 1958. 10p. Project No. 1183. $1.80(ph), $1.80(mf) OTS.

A series of tests was run to determine if balls can be removed from the annulus of a ball safety device. The balls were removed by a stream of dry air. Results are given for glass, steel, and iron balls ranging from $\frac{1}{16}$-inch to $\frac{1}{8}$-inch diameter. The removal time was small, in some cases as low as 14 sec. (W.D.M.)

19729 NAA-SR-Memo-3644
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SUMMARY OF FOULING RUNS 1, 2, AND 3 WITH IRRADIATED OMRE COOLANT. D. A. Huber. Mar. 11, 1959. 7p. $3.30(ph), $2.40(mf) OTS.

Studies were performed to determine the fouling tendencies of irradiated OMRE coolant at fuel channel conditions, as a function of bulk temperature, surface temperature, and bulk velocity past the element. A summary of the operating conditions for the high temperature runs is given. The variation of the heat transfer coefficient in each section of the test heater as a function of operation is shown for each of the three runs. (W.L.H.)

19730 NAA-SR-Memo-3881
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CONCEPTUAL DESIGN STUDY OF OMRE MODIFICATIONS. W. B. Wolfe. July 20, 1959. 53p. $10.80(ph), $3.90(mf) OTS.

A description is presented of a conceptual design for modifications to the Organic Moderated Reactor Experiment (OMRE). The OMRE facility was originally designed and built as a minimum cost irradiation facility intended to be operated for one year. Due to the very limited objective of the experiment, only the bare

minimum of building space and supporting facilities were provided. The experiment began operations in September 1957 and during the first year the original purpose of the OMRE was achieved. The feasibility of the concept was confirmed through the demonstration of low organic decomposition rates and the absence of fouling on heat transfer surfaces. In addition to successfully accomplishing its original objective, the reactor has demonstrated its capability for serving as a primary research facility for furthering the development of the organic reactor concept. It is presently supplying essential data on coolant decomposition, heat transfer, and fuel element performance. The proposed modifications provide the necessary plant improvements to enable the OMRE to perform more efficiently and effectively its increasing experimental task. The modifications are a logical extension of the facility's usefulness which will secure for the AEC's organic reactor development program a sizable increase in total experimental capability at a relatively low cost and a minimum of reactor down-time. (auth)

19731 NAA-SR-Memo-3899
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SUMMARY OF FOULING RUNS 4, 5, AND 6 WITH IRRADIATED OMRE COOLANT. D. A. Huber. May 21, 1959. 12p. $3.30(ph), $2.40(mf) OTS.

This investigation was performed to determine the fouling tendencies of irradiated Organic Moderated Reactor Experiment (OMRE) coolant as a function of bulk temperature, surface temperature, and fluid velocity past the test element. A summary of the operating conditions for the high temperature runs is given. The variation of the heat transfer coefficient in each section of the test heater as a function of operating time is shown for each of the three runs. (W.L.H.)

19732 NAA-SR-Memo-4075
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SUMMARY OF EXTENDED BOILING TEST NO. 5 WITH IRRADIATED OMRE COOLANT. D. A. Huber and J. Kortenhoeven. July 6, 1959. 7p. $1.80(ph), $1.80 (mf) OTS.

Studies were performed to demonstrate the feasibility of operating organic-cooled reactors for extended periods of time with irradiated organic coolant, under conditions of sub-cooled, nucleate boiling heat transfer at the fuel element surface. (W.L.H.)

19733 NAA-SR-Memo-4183
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SUMMARY OF ORGANIC COOLANT HEAT TRANSFER. W. R. Martini. July 23, 1959. 14p. $3.30(ph), $2.40 (mf) OTS.

Studies were made to determine the heat transfer coefficient and the rate of fouling of irradiated and unirradiated polyphenyl coolants. The rate of fouling of OMRE coolant was studied for a total of 1300 hours under conditions of forced convection, and for a total of 3200 hours under conditions of sub-cooled nucleate boiling heat transfer. (W.L.H.)

19734 NARF-59-25T
Convair, Fort Worth, Tex.
GTR THIN REFLECTOR EXPERIMENT. E. L. Jordan. July 20, 1959. 30p. Project 6(1-9964). Contract AF33 (600)-32054. (MR-N-236).

A series of experiments was made with the Ground Test Reactor (GTR) to determine an optimum reflector thickness for one reactor face which would make available a substantial increase in leakage flux without an excessive loss in reactivity. With a water reflector of two inches, neutron and gamma leakage fluxes were increased by a factor of 2.3 and 1.4 over the fluxes with an infinite reflector, while the loss in reactivity was 0.2%, within the safety limit set up for these experiments. Slabs of beryllium or lead (simulating test panels) were placed opposite the front face of the core, to determine the effect on the core reactivity of test panels with thermal-neutron reflector characteristics or fast-neutron backscatter properties. With the two-inch water reflector, the effect was to increase the level of reactivity to that of an infinite-reflector configuration. (auth)

19735 NDA-84-25
Nuclear Development Corp. of America, White Plains, N. Y.
DESIGN DEVELOPMENT TESTS OF SOME COMPONENTS FOR A CALANDRIA-TYPE REACTOR. D. Lee. July 27, 1959. 44p. Project II. Contract AT(30-1)-2303. $7.80(ph), $3.30(mf) OTS.

Results are presented from an experimental program on the development on sodium pipe joints. Objectives of the program were to produce a commercially reproducible calandria tube-tube sheet joint capable of joining and sealing a calandria tube-tube sheet, to produce a commercially reproducible fuel-coolant tube closure, and to determine the suitability of a Marman coupling for a zirconium-steel fuel tube joint for a high temperature reactor coolant application. (W.D.M.)

19736 NDA-84-26
Nuclear Development Corp. of America, White Plains, N. Y.
AN EVALUATION OF REFUELING SYSTEMS FOR NATURAL URANIUM REACTORS. G. Packer, M. Stuart, and P. Wachs. July 31, 1959. 31p. Project II. Contract AT(30-1)-2303. $6.30(ph), $3.00(mf) OTS.

The study is divided into four sections: (1) a survey of existing or proposed power reactor refueling systems, (2) the design of two basically different refueling machines for the same reactor plant, (3) the establishment of the ground rules (fuel cycles, plant load factor, refueling schedules, and costs) which govern the evaluation, and (4) the evaluation of the factors that relate the fuel cycle and the refueling system to the power cost. The designs of the shielded and unshielded refueling systems which were the basis for the cost studies in this report are discussed. Power costs for various combinations of fuel cycles and refueling systems are presented. (auth)

19737 NP-7765
Massachusetts Inst. of Tech., Cambridge.
WHIRLWIND PROGRAMMING OF S_2 APPROXIMATION FOR FLUX DISTRIBUTION IN A FINITE CYLINDRICAL REACTOR (thesis). William E. Campbell, Jr. and Vincent W. Panciera. June 1957. 107p.

A program is developed for the Whirlwind computer operating in the interpretive mode for the flux distribution in a finite cylindrical reactor. The reactor chosen for investigation was a hypothetical organic moderated, highly enriched, cylindrical reactor having a power output capable of fulfilling one half the propulsive requirements of a nuclear powered naval cruiser. Heat trans-

fer and basic physics calculations were accomplished to determine preliminary size and material requirements of such a reactor. The flux equations were derived using numerical integration methods suitable for computer programming. (auth)

19738 NYO-8586
Ford Instrument Co., Long Island City, N. Y.
DIGITAL START-UP CONTROL FOR AIRCRAFT REACTORS. Mar. 12, 1958. 27p. Contract AT(30-1)-1969. Dep.; $1.00(OTS).

An aircraft reactor start-up channel was selected for investigation to indicate the potential advantages of digitalizing a complete aircraft reactor control system. A start-up channel is described which retains present analog sensing techniques and replaces relays and vacuum tubes by digital transistor logic. It is concluded that this instrumentation will result in considerable reduction in size and weight and increased reliability. (auth)

19739 ORNL-2743
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING APRIL 30, 1959. Aug. 8, 1959. 276p. Contract W-7405-eng-26. $4.00(OTS).

Homogeneous Reactor Test. HRT run 18 was terminated after 1281 hr by the first scram in the history of the reactor. After several components were replaced or repaired, run 19 was begun, and circulating pump trouble developed. It was determined that the blanket pump was faulty, but the fuel pump had been improperly wired. The results of three additional hydroclone-system runs were not significantly different from previous runs. A multiple hydroclone unit containing 13 hydroclones was designed and fabricated for installation in HRT. Limits imposed by analytical sensitivity prevent a complete study of rare-earth behavior under reactor conditions. The radioactivity in 1,420,000 gal of reactor-cell shield water discharged this quarter was reduced from 350 to 2.2 curies of beta activity by adsorption on a calcium phosphate precipitate before disposal of the water from the retention pond. Design and development of tools for HRT remote operations continued. HRT component development activity included pump testing and evaluation, operation of the HRT core-model with transparent conical diffuser, and HRT mock-up operation. Design changes proposed and anticipated are briefly described. The effect of fuel in the HRT blanket region upon the neutron leakage from the reactor was computed, and the high-energy flux was calculated as a function of position for blanket-to-core fuel-concentration ratios of 0 and 0.33. HRT controls and instrumentation studies are briefly described. Reactor Analysis, Research, and Design. Studies showed that the core-wall temperature in a two-region reactor can be controlled by passing blanket slurry between the wall and a shroud. The effect of temperature distribution upon the maximum power density at the core wall was studied for long cylindrical reactors. The slurry concentration which gives the maximum critical temperature in small slurry reactors was obtained as a function of uranium-to-thorium ratio and moderator composition. Different two-group models and the harmonics method were used to calculate critical-mass ratios in small, reflected, slurry-core reactors. Two machine programs were written; one calculates group-averaged cross sections for use in multigroup programs; the other calculates the energy-group flux associated with uncollided and once-collided neutrons as a function of position in two-region reactors. Slurry dropout velocities as a function of volume fraction solids were studied in terms of an effective Reynolds number. A 30-gpm-loop slurry run was completed in which thoria was circulated at 275°C and about 450 g of Th per kg of H_2O. Design of the circulating-slurry critical system is reported. Engineering Development. The natural-circulation recombiner operated routinely for 1500 hr at 1500 psi. The temperature of the steam which could be circulated by the 20-cfm canned-motor blower was increased from 170 to 225°C. The three-stage contaminated-service oxygen compressor was placed on test and required several adjustments. A set of alumina check-valve trim was still serviceable after 1135 hr of slurry operation. Beryllia seats, operating against alumina balls, indicated deterioration after 200 hr. Data from thoria and thoria–urania slurry runs are given and discussed. A differential transformer designed for use at high temperature and in radiation fields exhibited no change in characteristics when cycled from 25 to 350°C. The transformer, which is wound with ceramic-insulated wire, has a sensitivity of 0.1 mv/v per 0.001 in. when used with appropriate exciting and impedance matching circuitry. Several ceramic coatings tested for possible use as an insulating sleeve in high-temperature magnetic flowmeters decomposed in 300°C oxygenated water in a static autoclave. An alternate power-control system for pressurizer heaters was built up from static components and satisfactorily tested on a dummy load of Calrod heating elements. Type 347 stainless steel bellows for use as valve stem seals exhibited a satisfactory life when cycled to failure in thorium oxide slurry at elevated temperature and pressure. A similar bellows assembly fabricated from grade Ti-55 titanium was cycled 11,600 times ($\frac{1}{2}$-in. strokes) before failing in 280°C uranyl sulfate solution at a pressure differential of 2300 psi. Reactor Materials Research. Studies concerned with the deposition of salts from simulated fuel solutions under boiling conditions were continued. Additional deposition tests were carried out in loop L-2-23 in which the core section was heated. Deoxidine-170 was the most effective of several reagents tested to determine their ability to dissolve stainless steel corrosion products. Zircaloy-2 and stainless steel were not significantly attacked by the reagent, but titanium specimens corroded at a rate in excess of 600 mpy. Simulated HRT fuel solution stability with regard to uranium concentration was studied. Preliminary tests in a uranyl sulfate solution indicate that an 18-8 stainless steel alloyed with either small amounts of platinum or copper is more corrosion resistant at low flow rates than a conventional 18-8 stainless steel; both alloys corroded at the same rate at high flow rates. A study was made to determine the susceptibility of off-specification type 347 stainless steel to intergranular attack by uranyl sulfate solutions. Continued testing with a single heat of cast type 347 stainless steel has confirmed previously reported data to the effect that the cast alloy is more resistant to stress-corrosion cracking than is the wrought alloy. Corrosion tests with Uniloy 19-9DL showed that the alloy in the annealed and in the annealed-and-aged condition has corrosion resistance similar to that of type 347 stainless steel in simulated reactor fuel solutions and has less tendency to gall than the austenitic stainless steels. The attack rate, rheological properties, and handling

characteristics of a D_2O slurry of mixed ThO_2-UO_3 (0.5% U/Th) containing a Pd-metal recombination catalyst under conditions simulating a proposed in-pile loop experiment were examined in a 100-A-loop test of 1036 hr. A loop test of 553-hr duration using an oxygenated slurry of 3- to 30-μ ThO_2 microspheres at 175°C at an average concentration of 295 g of Th per kg of H_2O is described. The addition of UO_3 (8% U/Th) to slurries of 1600°C-calcined ThO_2 which were circulated at 200°C at a nominal concentration of 500 g of Th per kg of H_2O were studied. Toroid tests were conducted at 280°C to compare the attack of a group of alloys in atmospheres of argon, deuterium, and oxygen using slurries of 650°C-calcined ThO_2 containing Pd-metal catalyst and additions of UO_3 at levels of 0.5 and 3% U/total solids. Three toroid runs comprised a series of tests with D_2O slurries of Th-8.8% U oxide (urania adsorbed on thoria) to compare the effects of temperature and atmosphere on the attack of a group of selected alloys and on the dissociation of uranium from the thoria-urania. Six commercial grades of aluminum oxide were corrosion tested in static slurry environments for possible usefulness as check balls in valves in slurry service. The Zircaloy-2 autoclave experiment (L6Z-1298) containing thoria-urania slurry at a concentration of 1090 g of Th per kg of D_2O, 5 wt. % U (coprecipitated) based on thorium, 0.0016 m Pd, and an oxygen atmosphere is reported. Operation of the development model of a 5-gpm loop continued. The first ORR in-pile loop, 0-1-25, was assembled, and out-of-pile testing and pretreatment of the loop began. The results of two autoclave experiments (L53T-132 and L51Z-137) of Zircaloy-2 corrosion at 280°C are presented and discussed. Experiment L53T-132 employed a titanium autoclave to expose three Zircaloy-2 coupons (and three titanium coupons) in an experiment designed to provide information on the transport of Zircaloy-2 corrosion product in autoclaves and on the effects, if any, of such transport on the radiation corrosion of Zircaloy-2. In experiment L51Z-137 a solution containing CO_2 was used in order to determine whether CO_2 could displace uranium sorbed on Zircaloy-2 and hence reduce the extent of corrosion. Corrected power-density values for previously reported experiments L52Z-136 and L6Z-133 are reported. Measurements of the adsorptive capacity of hydrous zirconium oxide for uranium from uranyl sulfate solutions at high temperature (250°C) are being made, utilizing a special high-temperature ion-exchange column. The macro- and microexaminations of the screen specimens removed from the HRT core tank after run 17 have been completed. As a part of the reactor maintenance program, tungsten-arc-melting and cutting procedures have been developed for cutting Zircaloy-2 under water. A study of the effects of fabrication variables on the preferred orientation and anisotropy of mechanical properties of Zircaloy-2 has progressed to the point that some correlations can be made between these properties and fabrication procedures for the variables of cross-rolling, alpha rolling temperatures, and beta quenching as an intermediate step. It has been shown to be feasible to fabricate 15-in.-diam. Zircaloy-2 hemispheres from flat plates with thicknesses of $\frac{1}{8}$ to $\frac{5}{16}$ in. by power spinning. The use of composite Inconel–stainless steel tubing and headers in homogeneous reactor design has been evaluated. Development on the remote machine-welding of Zircaloy-2 sections, $\frac{5}{16}$-in. thick and 2-in. in diam. into plate of the same thickness continued. In the fabrication of a Zircaloy-2 vessel, automatic, machine-driven welding appears much more desirable than manual or semiautomatic welding. Chemical Engineering Development. The yellow-green solid remaining after a simulated HRT fuel solution containing 1200 ppm of nickel was heated to 335°C and then cooled to 25°C was identified as nickel sulfate containing only trace amounts of copper and uranium. A 3-in.-diam. hydroclone operating at 30 gpm was no more effective for removing solids from a circulating loop than a 0.6-in.-diam. hydroclone operating at 1 gpm. The best method found so far for isolating the small amount of uranium contained in solids taken from the HRT was dissolution of the solids in 10.8 M H_2SO_4 and purification by anion exchange. About 60% of the uranium contained in 100 mg of solids can be recovered by this method. Scale was successfully removed by three methods from sections of the titanium corrosion-specimen holder which had been in the core of the HRT during run 17. Laboratory studies showed that nickel and manganese could be effectively removed from HRT fuel solution electrolytically. The gamma activity associated with a pump that had been removed from the HRT chemical plant was decreased from 200 to 10 r/hr by treatment with a chromous sulfate solution. Irradiation testing of a slurry of 650°C-fired thorium oxide (250 g of Th per kg of D_2O; 145 ppm palladium; 0.5 wt. % U^{235}, based on thorium) for 242 hr at 290°C in the LITR under an O_2 overpressure is described. Improved methods of cooling in-pile experiments are under development. The catalytic activity for D_2-O_2 recombination by a thorium-uranium oxide slurry containing a palladium catalyst was studied. A rolling-ball viscometer is under development for use with small volumes of slurry at room temperature and at elevated temperatures and ultimately for use with irradiated slurries. Addition of boric acid to keep a slurry reactor subcritical during startup was investigated. As shown by electron micrographs of shadow-cast particles, spherical particles were obtained by flame-firing at 1400°C alcoholic solutions of thorium-uranium-aluminum nitrates having a U/Th weight ratio of 0.08 and Al/Th weight ratios of 0.025 and 0.5. The use of fluidized-bed techniques to prepare 50- to 500-μ- diam. ThO_2 particles by direct denitration of $Th(NO_3)_4$ solutions was evaluated. Hydroclone classification was tested as a method for production of thorium oxide containing a high percentage of < 0.6-μ material. Supporting Chemical Research. A previously unidentified compound, $CuO \cdot 3UO_3$, has been discovered in the HRT fuel-solution system, the five-component system UO_3-CuO-NiO-SO_3-H_2O (D_2O), at 300°C. Improved methods have been developed for the preparation of appreciable quantities of the new compound $CuO \cdot 3UO_3$, and antlerite, $3CuO \cdot SO_3 \cdot 2H_2O$. Study of the two-liquid-phase regions of the system, UO_3-SO_3-H_2O, was extended to 350°C and to initial compositions having a SO_3:UO_3 molar ratio of 1.4 and uranium concentrations of 1.5 M. Recent efforts to find thorium solutions that would be stable at 300°C and suitable for consideration as breeder blankets were unsuccessful. Studies of the UO_3-HNO_3-H_2O system were resumed, with improved experimental methods. The solubility of $NiSO_4 \cdot H_2O$ (D_2O) in H_2SO_4-H_2O (D_2SO_4-D_2O) was determined at 250 and 300°C. Isotopic exchange and tracer studies of the mechanism of the homogeneous catalysis of the oxidation of dissolved hydrogen were continued. The precipitation of uranium peroxide from aqueous uranyl sulfate solutions upon the addition of dilute hydrogen peroxide was investigated. The number of theo-

retical plates in charcoal-filled pipes used for adsorbing fission gases from flowing oxygen was studied. Analytical Chemistry. A high-frequency titrimetric method was applied successfully to the determination of sulfate and free acid in solutions of uranyl sulfate. A study was made of the applicability of flame photometry to the determination of rare-earth elements in ThO_2, and a method was devised, utilizing flame photometry, for the estimation of Pd in slurries of ThO_2. Controlled-potential coulometric titrimetry has been applied to the determination of the U(IV)/U(VI) ratio in thorium oxide-uranium oxide mixtures. A spectrophotometric method was developed for the determination of Os in both microgram and milligram quantities in solutions of uranyl sulfate. An effective descaling agent, the trisodium salt of n-hydroxyethylethylenediamine triacetate (Versenol) in an ammonium acetate solution, disintegrated scale composed of the oxides of iron, chromium, and other metals, without damage to stainless steel containers. (For preceding period see ORNL-2696.) (T.R.H.)

19740 TID-3534

Technical Information Service Extension, AEC.

FUEL BREEDING. A Literature Search. James M. Jacobs, comp. Aug. 1959. 72p. $2.00(OTS).

A compilation is presented of selected references to data on breeding theory, breeder element and blanket design and fabrication, breeder reactors, and breeder reactor fuel elements. There are 696 references to unclassified reports. (T.R.H.)

19741 WAPD-AE(P)-116

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PWR BEARING FAILURE INTERIM REPORT. J. E. Berger. Oct. 21, 1955. 3p. Contract AT-11-1-GEN-14. $1.80(ph), $1.80(mf) OTS.

Test conditions just prior to and after the pump failure are reported. Special test procedures for a pump of this type under similar conditions are given. (C.J.G.)

19742 WAPD-PWR-Ph-494

Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.

COMPARISON OF VARIOUS ONE-DIMENSIONAL TRANSPORT THEORY APPROXIMATIONS. P. H. Wackman. Oct. 7, 1958. 3p. $1.80(ph), $1.80(mf) OTS.

The problem of the self-shielding of a highly absorbing poison lump cannot be solved adequately by diffusion theory, even in one dimension. Recourse to a higher order approximation to the transport equation must be made. The self-shielding factors computed using various transport theory codes are compared for a specific problem which bears some resemblance to a PWR Core 2 configuration. (W.D.M.)

19743 YAEC-157

Westinghouse Electric Corp. Atomic Power Dept. Pittsburgh.

MONTHLY PROGRESS REPORT FOR THE PERIOD JULY 1 TO JULY 31, 1959. H. E. Walchli. Aug. 20, 1959. 13p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph), $2.40(mf) OTS.

The work performed by the Westinghouse Atomic Power Department for the Yankee Atomic Electric Company during the month of July 1959 is summarized. (For preceding period see YAEC-134.) (W.L.H.)

19744

CHEMICAL ENGINEERING UNIT OPERATIONS HELP SOLVE ATOMIC POWER PLANT PROBLEMS. C. F. Stolzenbach (Consolidated Edison Co. of New York). Chem. Eng. 66, No. 17, 123-8(1959) Aug. 24.

Problems encountered by chemical engineers in design of the Indian Point nuclear power plant are choice of materials of construction to resist corrosion and radioactivity, handling and disposing of hydrogen and oxygen (cooling-water-decomposition products due to radioactivity), preparation of ultra-pure feed water for the reactor coolant cycle, and handling of solid, liquid, and gaseous radioactive wastes. (C.J.G.)

19745

NUCLEAR. Richard P. Godwin (U. S. Atomic Energy Commission, Germantown, Md.) and Edward S. Dennison (General Dynamics Corp., Groton, Conn.). J. Eng. Power 81, 352-9(1959) July.

Selection of the optimum working fluid for a direct-cycle, gas-cooled reactor and gas turbine can be made only after weighing the advantages and disadvantages. The gases covered in this paper (He, CO_2, N, and air) represent the known fluids which can be utilized in a practical manner. He is the only one presenting a problem regarding availability. Regarding chemical activity, He is the best choice since CO_2 and air will cause oxidation in the presence of graphite, and N has an undesirable nitriding effect. Regarding radioactivity, He is also the best choice. The efficiency of a CO_2 cycle is high, one reason being the reduced power required for compression. He has better heat transfer characteristics, but leakage would be a big problem. (C.J.G.)

19746

THE STEAM COOLED REACTOR. Norman Battle. Nuclear Energy Engr. 13, 396-99(1959) Aug.

A heavy-water-moderated, steam-cooled reactor system is proposed for nuclear propulsion of surface ships. Total weight of the proposed reactor plant including containment is 2,100 tons with a heat output of 150 Mw. Reactor control through heavy water level changes by means of valves is possible. Problems of securing the moderator in place and of possible jamming of control rods do not arise. The fuel rods are composed of UO_2 in 0.500 in. diameter, 0.750 in. long sintered pellet form, clad with 0.010 thick austenitic steel. Maximum temperature is 680°C and fuel center temperature 1,700°C. Total shield thickness of 4 ft. 6 in. is found to be necessary, of which 25 in. are of steel and 29 in. are of water, including the water which forms part of the core reflector. Surface dose rate is approximately 1 rem/hr at full power. (C.J.G.)

19747

HYDROCARBONS IN POWER REACTOR PLANTS. I. THE ORGANIC MODERATED REACTOR EXPERIMENT. Nuclear Energy Engr. 13, 402-6(1959) Aug.

A mixture consisting of mainly ortho- and meta-terphenyl, with small amounts of diphenyl and para-terphenyl, is used as coolant, reflector, and moderator. No evidence of any tendency on the part of the decomposition products so formed to separate from the bulk of the coolant and deposit on either hot or cold transfer surfaces was found. Pyrolytic damage was insignificant at 600°F. Results show that 7.8 per cent of the OMRE energy is absorbed in the moderator coolant. Highest radiation level measured in process

area during operation of reactor at a power level of 10 Mw was 80 mr/hr at surface of 10 in. pipes and surface of filter removing particulate matter from system. The radiation level in the center of area was 13 mr/hr. As the high boiling compound concentrations increased to 40 per cent, there was a slow and gradual decrease in heat transfer coefficient. (C.J.G.)

19748

NONLINEAR TREATMENT OF LARGE PERTURBATION IN POWER REACTOR STABILITY. H. A. Sandmeier (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 6, 85-92(1959) Aug.

For large perturbations the usual assumption in power reactor stability that the flux variations δn are small in comparison with the steady-state flux level n_0 is not valid. Due to the product term of excess reactivity and neutron flux, harmonics are generated in the flux. The stability under such conditions can be discussed by extracting the fundamental flux component and obtaining a quasi frequency response as the ratio of fundamental incremental flux component to excess reactivity as a function of frequency and amplitude of perturbation. This approach is applied to two Argonne power reactors, the Experimental Boiling Water Reactor and the Experimental Breeder Reactor, where experimental frequency responses have been obtained and a peak has been observed. It is found that for both reactors the stability decreases as the amplitude of perturbation increases. (auth)

19749

RADIOACTIVE WATER POSES NEW PROBLEMS. C. T. Dickert, R. Hetherington, and C. F. Raines. Power 102, 88-90(1958) Sept.

The problems caused by water impurities in power reactors are reviewed. Although high-pressure conventional steam boilers require high-quality water, the standards for nuclear reactor systems are extraordinarily high by comparison. Adverse chemical reactions include the normal corrosion reactions between metal and water and between metal and dissolved oxygen; the dissociation of water by fast neutrons, producing oxygen which in turn increases corrosion; and radiation catalyzed reactions such as the synthesis of nitric acid from nitrogen and oxygen under the influence of neutron radiation. Corrosion products may go into solution or suspension, or may form deposits or scale on equipment. All forms are subject to radiation, and long-lived radioactive species can make the reactor compartment inaccessible. Deposits interfere with close-tolerance mechanisms such as throttling valves and control-rod drives. Deposits of corrosion products from stainless steel seriously affect heat transfer. Argon and xenon can be added with air dissolved in makeup water, causing added troubles. Argon is irradiated to argon-41. Xenon-135 has a large cross section for neutron capture, which reduces the multiplication factor sustaining the chain reaction in the reactor. (auth)

STABLE ISOTOPE SEPARATION

19750 A/CONF.15/P/1000

ENRICHMENT OF HEAVY WATER BY HIGH-PRESSURE EXCHANGE BETWEEN HYDROGEN AND AN AQUEOUS SUSPENSION OF A CATALYST. Paper presented at the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958. E. W. Becker, K. Bier, R. P. Hübener, and R. W. Kessler (Univ. of Marburg, Ger.). 30p. $0.50(OTS).

Chemical exchange between hydrogen and water is especially suitable for producing heavy water because of the relatively high elementary separation factor. In present technical applications of this system, the necessary catalysis of the isotope exchange is carried out in the gaseous phase. But this has certain economic disadvantages, e.g., the necessary overheating of the gaseous streams before entering the catalyst beds and the relatively high cost of the special columns. A sufficiently high exchange velocity can be achieved in the liquid phase provided the catalyst is not firmly imbedded in the columns, but rather applied in the form of a dispersion or sol under high pressure. In this case the enrichment can best be carried out in dual-temperature columns along the lines of the well-known hydrogen sulfide process. A platinum based dispersed catalyst with sufficient temperature resistance was developed. Its exchange capacity was determined in relation to the essential parameters in an experimental plant operating under high pressure. The energy consumption, platinum requirements, and column volume of an industrial plant were calculated on the basis of these measurements. The process promises considerable advantages over those used hitherto for enriching heavy water. (auth)

19751 DP-3

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Augusta, Ga.

S-PROCESS PILOT PLANT-FIRST RUN RESULTS AND PROCESS PRINCIPLES. D. F. Babcock, C. B. Buford, Jr., and J. W. Morris. Nov. 23, 1951. Decl. Feb. 16, 1957. 72p. $12.30(ph), $4.50(mf) OTS.

The S-Process (dual temperature, hydrogen sulfide) for the extraction of heavy water from natural water has been evaluated in single-stage pilot-plant operation at the Dana Plant. Extraction capacity was demonstrated to check theory within the limits of experimental accuracy, and the bubble cap tray efficiency was demonstrated to be an average of at least 45% versus design estimates of 50%. This report summarizes certain process calculations and presents several novel theoretical concepts of the process theory. (auth)

19752 DP-400

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.

PRODUCTION OF HEAVY WATER SAVANNAH RIVER AND DANA PLANTS. Technical Manual. W. P. Bebbington and V. R. Thayer, eds.—J. F. Proctor, comp. July 1959. 164p. Contract AT(07-2)-1. $3.00 (OTS).

A summary is presented of the basic technical information that pertains to processes that are used at the Dana and Savannah River Plants for the production of heavy water. The manual is intended primarily for plant operating and technical personnel and was prepared to supplement and provide technical support for detailed operating procedures. Introductory sections contain some background information on the history, uses, available processes, and analytical procedures for heavy water. They also include a general comparison of the design and performance of the two plants and an analysis of their differences. The technology of the heavy water separation processes used, namely hydrogen sulfide exchange, distillation of water, and electrolysis is discussed in detail. The manufacture and storage of hydrogen sulfide gas and the process water treatment facilities are also discussed. (auth)

19753 ORO-202

Virginia. Univ., Charlottesville. Ordnance Research Lab.

THE DEVELOPMENT OF SHORT BOWL ULTRACENTRIFUGES. Progress Report. Gernot Zippe. July 1, 1959. 19p. Contract [AT(40-1)-2400]. (UVA/ORL-2400-59-PR-1). $3.30(ph), $2.40(mf) OTS.

Progress is reported on lifetime tests of rotors and determination of power loss of the scoop system. (T.R.H.)

19754 CEA-tr-A-590

NOUVEAU PROCÉDÉ DE SÉPARATION DES ISOTOPES. (New Procedure for the Separation of Isotopes.) F. Schultz-Grunow. Translated into French from Z. angew. Math. u. Phys. 9b, Nos. 5-6, 628-36 (1958). 18p.

The separation of mixtures by the use of thermodiffusion is discussed, and the disadvantages of the process are reviewed. However, the disadvantages of the process can be removed by the use of a rotation disk in a tight enclosure. The powerful laminar circular current that is obtained is to a large extent independent of the dimensions of the apparatus and is completely independent of the temperature differences. The apparatus used in the experimental separation of nitrogen and argon is described. The apparatus has the additional advantage of being usable with liquids as well as gases. The results obtained in the separation of argon–nitrogen mixtures are given. The process can be used for the separation of isotopes. (J.S.R.)

TECHNOLOGY

Raw Materials

19755 NP-7807

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

LEACHING OF ASHES OF CARBONACEOUS URANIUM ORE WITH SULPHURIC ACID. Report No. 85/IV. K. Pinkas and D. Szymańska. May 1959. 8p.

In order to compare acid and alkaline methods of processing carbonaceous uranium ore and to investigate the leaching of ashes of such ores, preliminary studies on leaching with sulfuric acid were carried out. The results suggest practicability of processing ashes with dilute sulfuric acid when the ore is roasted, or additionally reroasted with sodium bisulfate in a temperature of 600°C. Good results are obtained by mixing carbonaceous and non-carbonaceous ores, which makes it possible to use roasting temperatures of 600°C or below. Combustion at temperatures above 600°C adversely affects leaching of ashes. (auth)

19756 NP-7808

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

THE CONTENT OF RADIUM IN SOLUTIONS AFTER ALKALINE LEACHING OF URANIUM ORES. Report No. 84/IV. R. Przytycka. May 1959. 11p.

The behavior of radium during alkaline leaching of 6 various uranium ores was examined. The alkaline solutions were found to contain radium in concentrations ranging from decimal fractions of per cent to 5% of that in ores. (auth)

19757 ORNL-2771

Oak Ridge National Lab., Tenn.

EMULSION STABILIZATION BY SILICIC ACID. K. A. Allen and W. J. McDowell. Aug. 31, 1959. 16p. Contract W-7405-eng-26. $0.50(OTS).

With a given amine (vs. an aqueous phase containing silicic acid) the stability of the emulsion formed was dependent on the anion present in the order $SO_4^{=}$ (most stable) > Cl^- > ClO_4^- (least stable). Emulsion stability increased with silicon concentration and with the age of the silicic acid solution. Other organic solutes that also had electron-donating tendencies (e.g., oxygen atoms) showed smaller but real emulsion-forming abilities when contacted with silicic acid liquors. Organic additives with active hydrogen atoms decreased phase separation times of a typical silica liquor-amine sulfate solution dispersion by factors of 2 or more, presumably by competing with the silicic acid hydrogen atoms for bonding sites on the amine sulfate oxygens. It is suggested that silicic acid stabilizes oil-in-water type emulsions by hydrogen bonding to electron-donating groups adsorbed on the surfaces of the organic droplets and by forming typical silicic acid networks in the aqueous phase. (auth)

19758

THORIUM SEPARATION FROM MONAZITE. M. Z. Hathout (Assiut Univ., Egypt). Nuclear Energy Engr. 13, 407-10(1959) Aug.

A discussion is presented of several extraction processes of thorium compounds from monazite sand. Modifications of the sulfuric acid processes involving either partial neutralization to effect fractional precipitation or by carbonate separation are given. A process using ammonium hydroxide to precipitate the thorium selectively from monazite sulfate solution is presented. (C.J.G.)